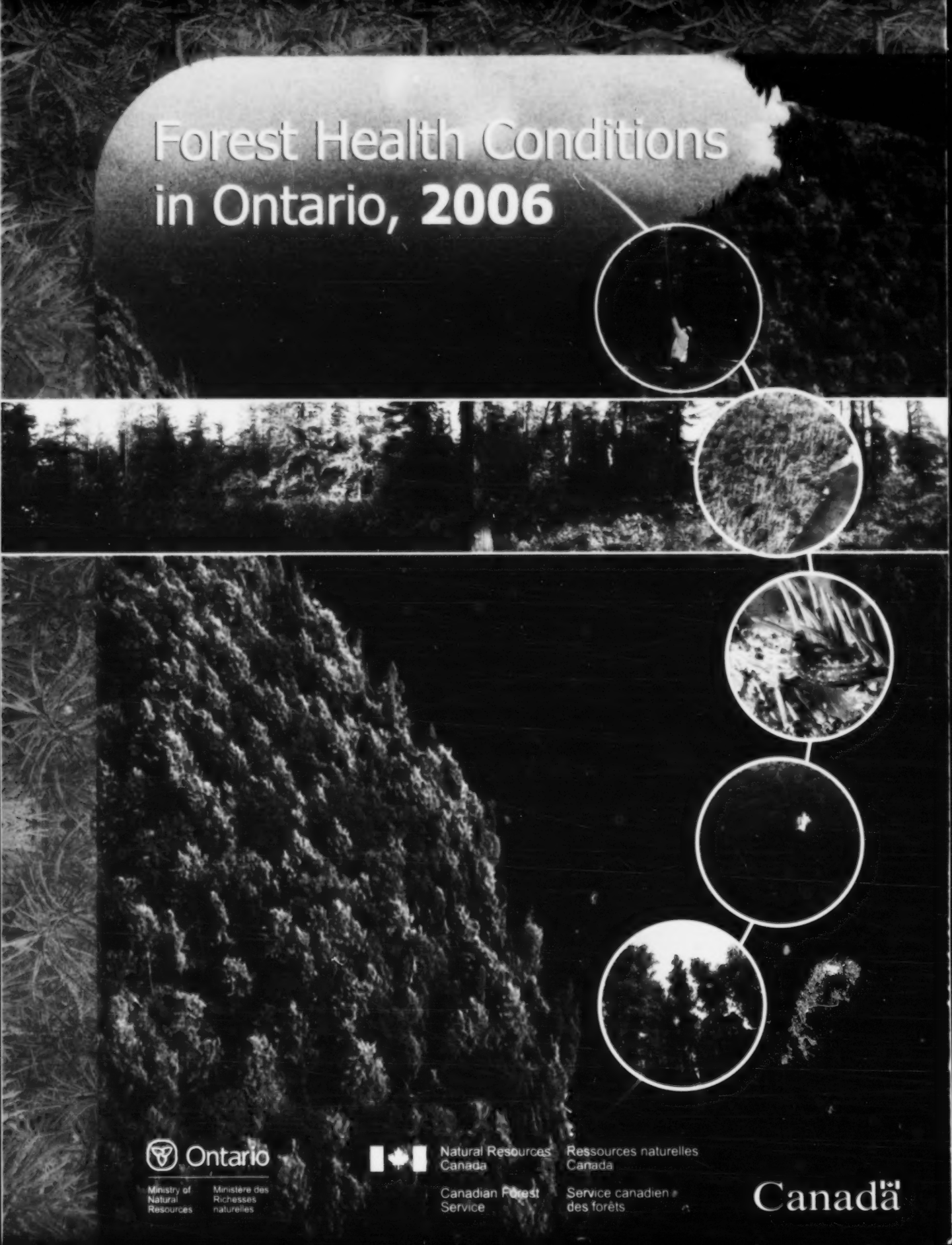
Forest Health Conditions in Ontario, **2006**



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Forest Health Conditions in Ontario, **2006**

Edited by T. Scarr[1], A. Hopkin[2] and J. Pollard[1]

[1] *Ontario Ministry of Natural Resources, Forest Management Branch, Forest Health & Silviculture Section*
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Field staff for Ontario's Forest Health Monitoring Program are:
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Hugh Evans[2] (Midhurst-Aurora)
Mike Francis[1] (Thunder Bay-Nipigon)
Wayne Ingram[1] (Algonquin Park-Pembroke-Kemptville)
Al Keizer[2] (Timmins-Kirkland Lake-North Bay)
Doug Lawrence[2] (Sault Ste. Marie)
Dan Rowlinson[1] (Wawa-Chapeau)
Lincoln Rowlinson[1] (Kenora-Fort Francis)
Barry Smith[2] (Dryden-Red Lake-Sioux Lookout)
Linda Tucker[1] (Guelph-Aylmer)
Additional field support provided by Dave Comba[2], Harri Liljalehto[1], and Scott MacLeod[1].

Sirex noctilio field collections were done by Steve Marks[1] and Claudia Martel[1] with screening and sample preparation done by Katrina Cinnani[1], Sarah Drabble[1], and Madeline Alyea[1]. Thanks to Al Foley[1] for the use of the Ontario Tree Seed Plant as a field base. Peter de Groot[2] provided scientific leadership to the *Sirex noctilio* survey, with technical support from Reg Nott[2] and Roger Sharbach[2].

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[1] *Ontario Ministry of Natural Resources, Forest Management Branch, Sault Ste. Marie*
[2] *Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie*

Introduction

SECTION 1

This is a report of the forest health conditions as reported by Ontario's Forest Health Monitoring Program, caused by insect, disease, and abiotic disturbances in 2006. This report also includes disturbance from invasive forest species and regulated quarantine pests whose management fall under federal responsibility with the Canadian Food Inspection Agency (CFIA).

The Forest Health Monitoring Program in Ontario is a partnership between the Ontario Ministry of Natural Resources (MNR) and the Canadian Forest Service (CFS). The program provides 6 MNR and 6 CFS field staff for regular forest health monitoring in 12 work areas covering the province of Ontario (Figure 1.1).

Through a systematic monitoring program including ground and aerial surveys, the field staff record forest health occurrences across Ontario. Identification is done through insect, disease and plant samples collected in the field and submitted to the Canadian Forest Service, Great Lakes Forestry Centre for confirmation. Forest Health Updates are provided throughout the field season to client groups including industry, government, public and other resource stakeholders to provide timely information on developing forest health issues.

This report is a synopsis of updates throughout the field season and includes major forest disturbances (MFDs), invasive forest pests and a regional-level reporting of forest health issues. It includes biotic (e.g. insect defoliation) and abiotic events (e.g. blowdown). For forest management and forest health monitoring administration, the province is divided into the Northwest, Northeast and Southern Regions (Figure 1.2).

Red Lake
Sioux Lookout
Nipigon
Cochrane
Kenora
Dryden
Hearst
Fort Frances
Thunder Bay
Wawa
Timmins
Kirkland Lake
Chapleau
Sault Ste Marie
Sudbury
North Bay
Parry Sound
Pembroke
Kemptville
Bancroft
Peterborough
Midhurst
Aurora
Cambridge
Aylmer
Northwest Region
Northeast Region
Southern Region

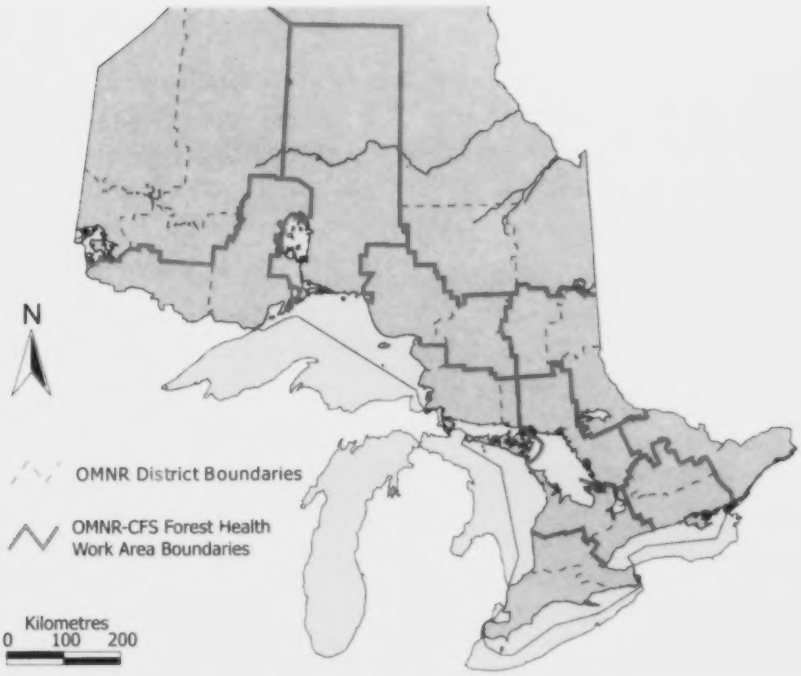


Figure 1.1 Forest health work areas in Ontario.

Figure 1.2 Administrative regions and districts of Ontario.

This report is divided into sections representing provincially significant events, invasive species, and forest health conditions for each of the OMNR administrative regions (Northwest, Northeast, and Southern Regions).

Several major forest health issues have surfaced in recent years in Ontario. The jack pine budworm outbreak, which began in the Northwest region in 2005, continued to expand in 2006. The Ontario Ministry of Natural Resources conducted an insect pest management program for this pest beginning in 2006. The invasive species, emerald ash borer has continued to expand its area of infestation in southwestern Ontario. Other significant forest health issues in Ontario in 2006 included an expanding spruce budworm infestation in northeastern Ontario and a growing gypsy moth problem in southern Ontario. All these forest health issues have been compounded and influenced by a series of hot, dry summers and reduced average annual precipitation in Ontario contributing to abiotic stresses in our forests.

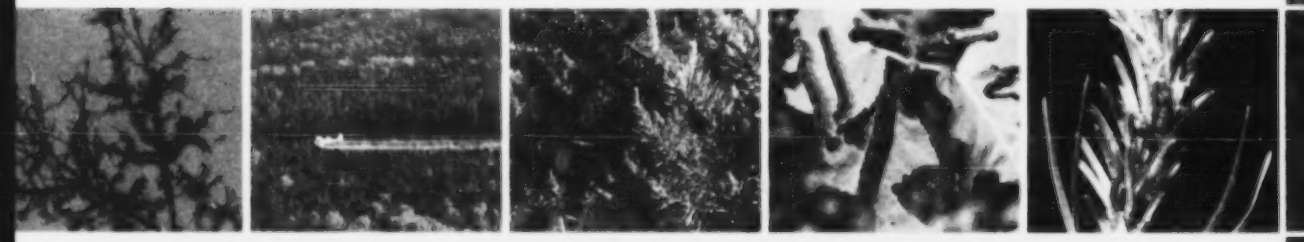
These and other forest health concerns are outlined in this report. The forest health monitoring partnership continues to monitor for these and other developing forest health issues, so that Ontario can be prepared and manage for forest disturbances.

There are many forest pests not reported on here that affected forests and trees in Ontario in 2006. These may not have been reported because they were relatively insignificant in this reporting year, small in spatial extent, or identification of the causal agent could not be confirmed. This report has been organized in sections with insects and diseases appearing in alphabetical order by scientific name. The table of contents can also be used to determine the location of a specific forest health issue within the report.

Provincially Significant Forest Pests

H.J. Evans[2], B. Biggs[2], M. Francis[1], A. Keizer[2], L. Rowlinson[1]

[1] *Ontario Ministry of Natural Resources, Forest Management Branch, Forest Health & Silviculture Section*
[2] *Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie*



Spruce budworm, *Choristoneura fumiferana* (Clem.)

There was a significant enlargement of the spruce budworm infestation in 2006. The majority of this expansion occurred in the North Bay District of Northeastern Ontario. The area of infestation totalled 797,206 ha in 2006, an increase from 337,485 ha recorded last year (Table 2.1 and Figure 2.2).

Severe defoliation of white spruce (*Picea glauca* (Moench) Voss), black spruce (*Picea mariana* (Mill.) BSP), and balsam fir (*Abies balsamea* (L.)), expanded in all directions in North Bay District. The main body of the infestation persisted along the Sudbury District boundary in the Warren and Riviere Veuve area north to McNish Township. It also progressed further north to the south end of Obabika Lake and then eastward to the town of Temagami and Rabbit Lake. The south end of the infestation encompassed most of the Nipissing Crown Game Preserve, then swept east again almost to the Ottawa River in Clarkson Township. The southern boundary is a line from Eddy Township to the town of Sturgeon Falls. Newly infested areas were mapped south of Highway 17 across the west end of Lake Nipissing and then further south to the French River, then east to just west of the towns of Powassan and Trout Creek. New areas of infestation were also mapped around the city of North Bay and south of the town of Mattawa.

Figure 2.1 Spruce budworm larva feeding on white spruce (photo by A. Keizer).

Table 2.1 Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 2003 – 2006.

Region	Area (ha)			
District	2003	2004	2005	2006
Northwest				
Kenora	1 188	138	209	0
	1 188	138	209	0
Northeast				
North Bay	158 305	187 854	250 936	690 731
Sault Ste. Marie	0	0	302	3 250
Sudbury	41 071	40 448	47 768	72 739
	199 376	228 302	299 006	766 720
Southern				
Bancroft	3 805	6 675	0	0
Kemptville	2 117	11 381	9 238	6 341
Parry Sound	0	0	0	2 796
Pembroke	22 818	32 858	28 988	21 349
Peterborough	422	470	44	0
	29 162	51 384	38 270	30 486
TOTAL	229 726	279 824	337 485	797 206

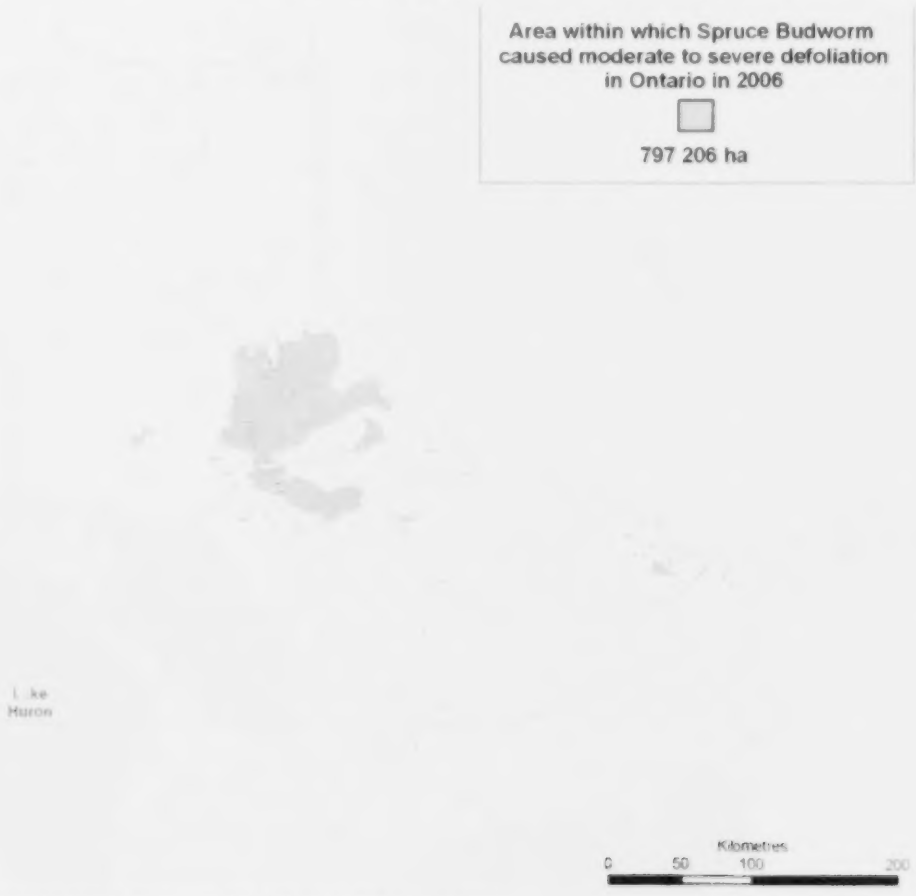


Figure 2.2 Area of spruce budworm defoliation in Ontario in 2006.

Table 2.1 Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 2003 - 2006.

Region / District	Area (ha)			
	2003	2004	2005	2006
Northwest				
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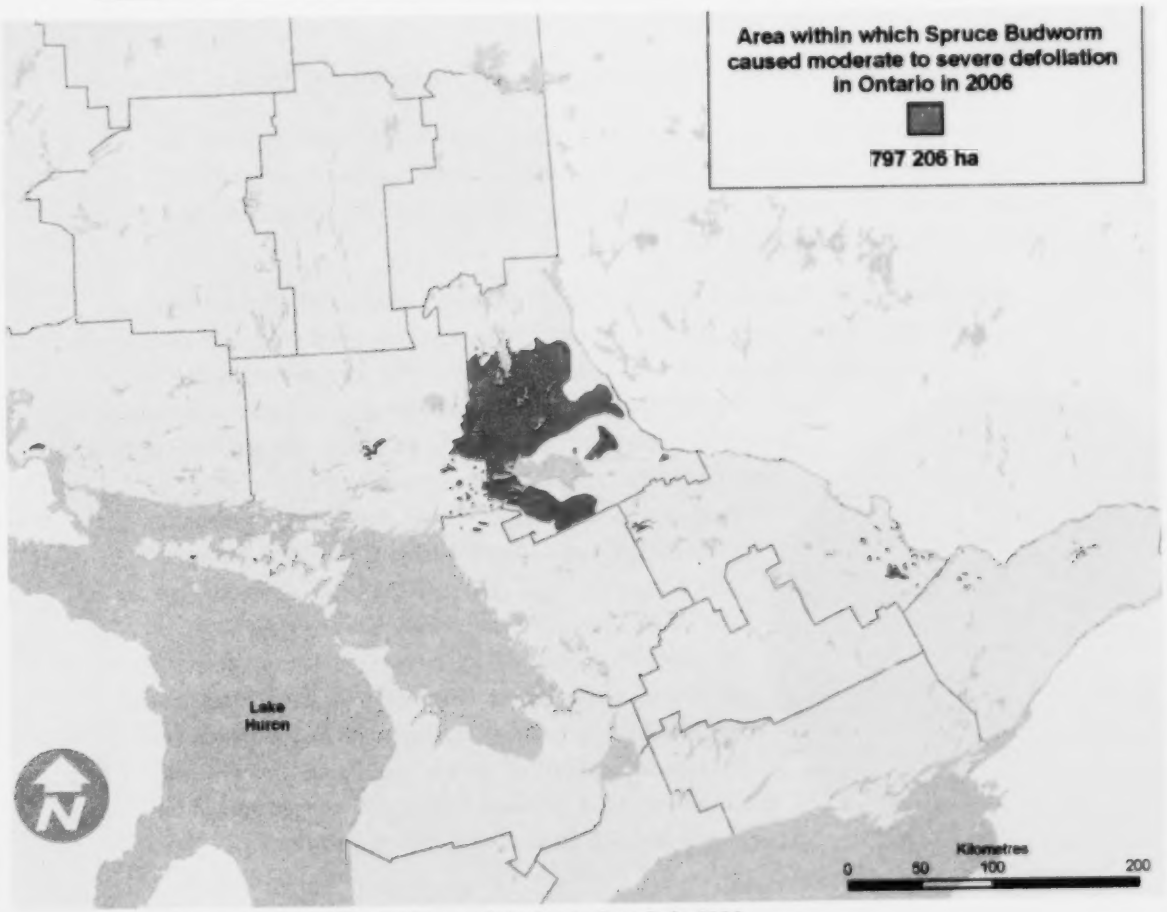

Figure 2.2 Area of spruce budworm defoliation in Ontario in 2006.

In North Bay District, the area of moderate-to-severe defoliation expanded to 690,731 ha from the 250,936 ha infested in 2005. The area of moderate-to-severe defoliation in the Sudbury District increased from 47,768 ha last year to 72,739 ha in 2006. There was not much change to the area along the border with North Bay District. Significant defoliation recurred from St. Charles north to the south end of Maskinonge Lake in Kelly Township and west to Markstay. Throughout Sudbury District significant damage was found in Davis, Loughrin, Hagar, Ratter, Appleby, and Dunnet townships; and to a lesser extent, in Awrey, Hawley, and Casmir townships. However, there were numerous pockets mapped in the southeast corner of the district east of Highway 69 to the boundary with North Bay District. In addition, the infestation west of the City of Greater Sudbury, first mapped in 2005, expanded in an east-west direction. Presently it extends from Fairbank Lake east to Highway 144. Also in Sudbury District pockets of spruce budworm defoliation in the Lake Kagawong area on Manitoulin Island expanded this year and a new area of white spruce defoliation was mapped in Robinson Township.

Figure 2.3 White spruce branch, severely defoliated by spruce budworm (photo by W. Ingram).

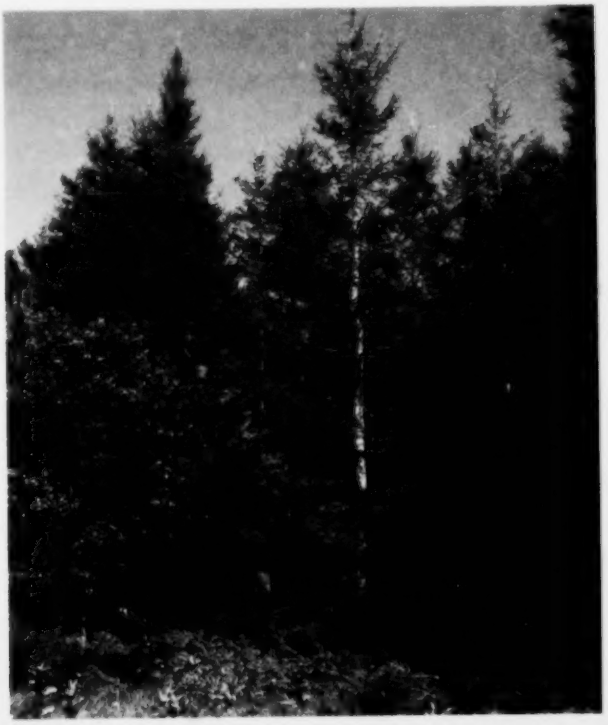

Figure 2.4 Defoliation by spruce budworm (photo by W. Ingram).

In Sault Ste. Marie District, the area of moderate-to-severe defoliation increased from 302 ha in 2005 to 3,250 ha in 2006. All of the defoliated areas were in the vicinity of the city of Sault Ste. Marie.

There were newly-infested areas on 2,796 ha of forest in the northwestern part of Parry Sound District in southern Ontario. Two large pockets of moderate-to-severe defoliation were observed in Blair and Mowat townships. A smaller area of defoliation was present along the western side of Grundy Lake Provincial Park. In Algonquin Park there were

increases in the extent of damage in Paxton, Biggar and Butt townships. There was an overall decline in the affected area in Pembroke District, decreasing from 28,988 ha in 2005 to 21,349 ha in 2006. In Kemptville District, the area of infestation also decreased from 9,238 ha infested in 2005 to 6,341 ha in 2006. The overall area of moderate to severe defoliation in the Southern Region decreased from 38,270 ha in 2005 to 30,486 ha in 2006.

In the Northwest Region, the only recorded damage due to spruce budworm was in the Fort Frances District where there was 317 ha of light defoliation recorded. This occurred in one area approximately 12 km northwest of Mine Centre on First Nation Reservation 26C located north of Highway 11 approximately 8-10 km on the west side of the Turtle River Road. This area surrounds a small section of the Big Turtle River. Fluctuating population levels of spruce budworm have been occurring in the southwest corner of the Fort Frances District for the past four years. In 2005, 209 ha of severe defoliation was aerially mapped on the shore line of many of the islands south of the Aulneau Peninsula on Lake of the Woods. This same area had 138 ha mapped in 2004 and 1188 ha in 2003.

In parts of North Bay and Sudbury districts where spruce budworm has occurred for several consecutive years, tree mortality has been recorded. There were 17,060 ha within which tree mortality occurred in 2005. In 2006, there were new small areas of tree mortality and top dieback recorded near the southwest arm of Lake Temagami in Hobbs, Pardu, Clement and Peninsula townships and near the town of Field, Bastedo Township, North Bay District (Figure 2.5). The area within which new mortality occurred is 2,796 ha for a cumulative total of 19,856 ha. As well, further south there were numerous points of spruce budworm-related tree mortality reported in the Pembroke and Kemptville districts (Table 2.2 and Figure 2.6).

Table 2.2 Cumulative area of spruce and balsam fir mortality caused by the spruce budworm in Ontario, 2003 - 2006.

Region	Area (ha)			
District	2003	2004	2005	2006
Northeast				
North Bay	3 549	9 839	11 748	14 544
Sudbury	3 920	3 974	5 312	5 312
TOTAL	7 469	13 813	17 060	19 856

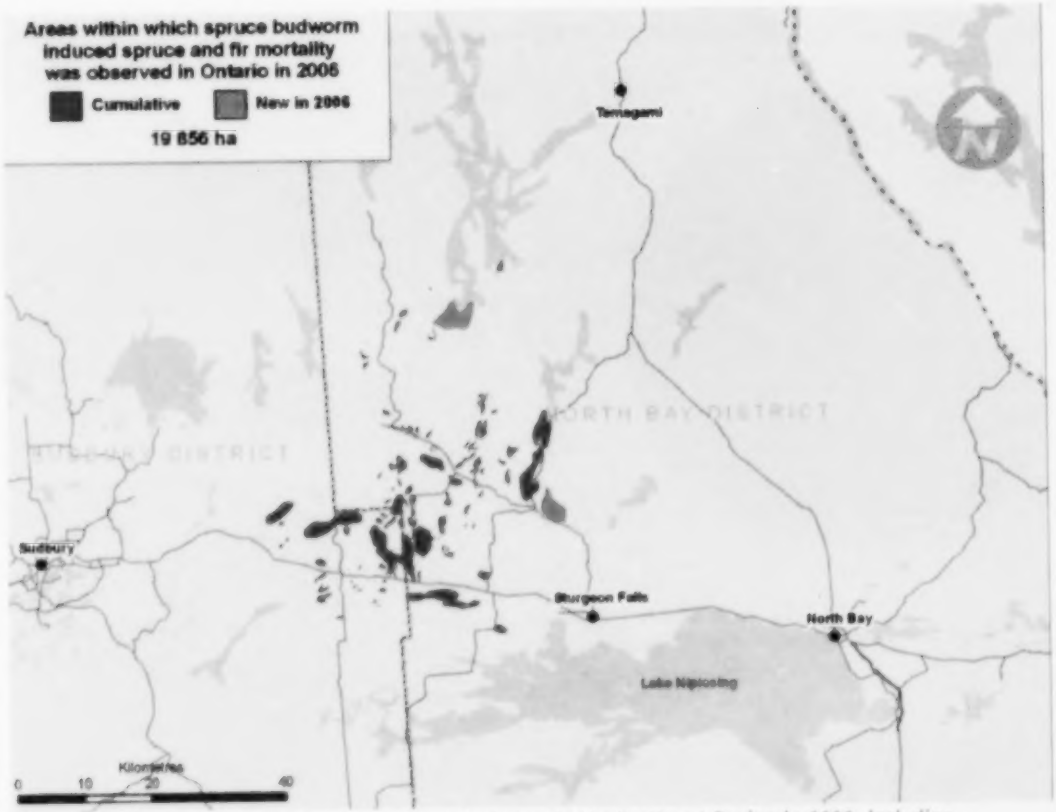

Figure 2.5 Area of mortality caused by spruce budworm in the Northeast Region in 2006, including cumulative mortality from previous years.

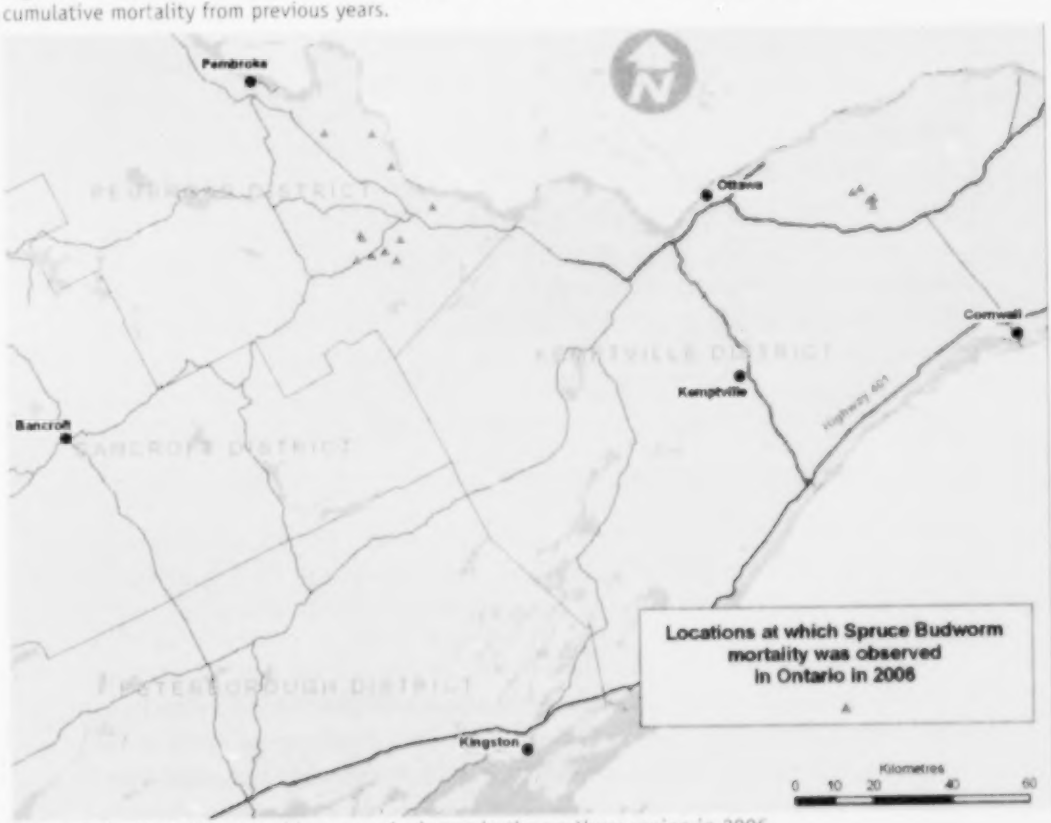

Figure 2.6 Mortality caused by spruce budworm in the southern region in 2006.

Figure 2.5 Area of mortality caused by spruce budworm in the Northeast Region in 2006, including cumulative mortality from previous years

Figure 2.6 Mortality caused by spruce budworm in the southern areas in 2006

Jack pine budworm, *Choristoneura p. pinus* Free.

There was a significant increase in the area defoliated by jack pine budworm in 2006. This marks the third year of the current outbreak in Ontario which began in the Northeast Region in 2004. The pest is present in all three regions of the province with the most severe and extensive part of the infestation in the northwest. In Ontario, the total area of moderate to severe defoliation to jack pine (*Pinus banksiana* Lamb.) was 740,116 ha in 2006. There was an additional 29,679 ha of light defoliation. (Table 2.3 and Figure 2.8).

Figure 2.7 Jack pine budworm larvae feeding on jack pine (photo by M. Francis).

Table 2.3 Gross area of moderate-to-severe defoliation caused by the jack pine budworm in Ontario, 2004 - 2006.

Region	Area (ha)		
District	2004	2005	2006
Northwest			
Dryden	0	1 983	116 195
Fort Frances	0	85 328	355 134
Kenora	0	1 134	248 843
	0	88 445	720 172
Northeast			
Sault Ste. Marie	0	953	951
Sudbury	851	2 599	14 038
	851	3 552	14 989
Southern			
Parry Sound	0	0	4 548
Pembroke	0	222	407
	0	222	4 955
TOTAL	851	92 219	740 116

In the Northwest Region in 2005, almost all of the defoliated area was within Fort Frances District. While in 2006 the largest area of damage was again in Fort Frances District, there were also large increases and expansions of defoliation in Kenora and Dryden districts.

In Fort Frances District the area of moderate-to-severe defoliation enlarged from 85,328 ha in 2005 to 355,134 ha in 2006. In 2005, the infestation was mostly in the central part of the district where it intensified in 2006. To the north and west of Fort Frances District, infested areas extended well into Dryden and Kenora districts. Some of

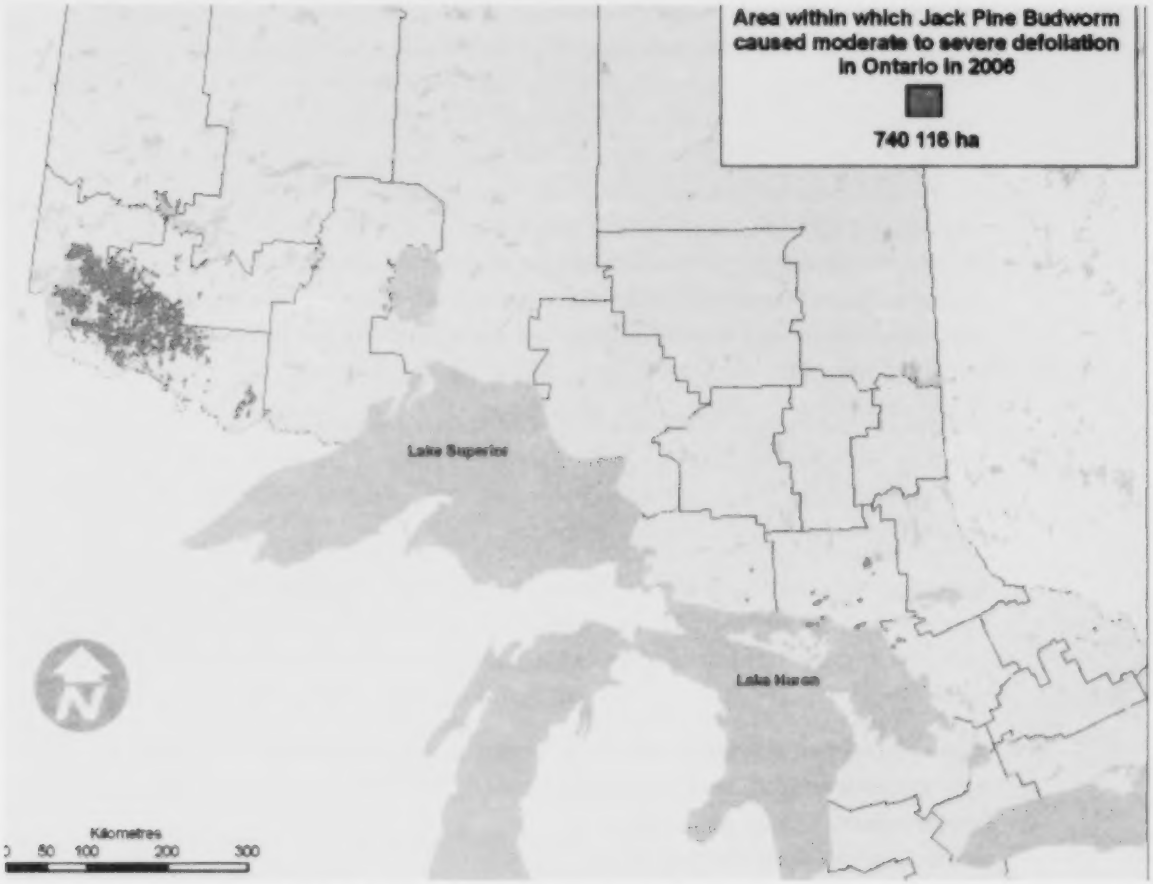
Area within which Jack Pine Budworm caused moderate to severe defoliation in Ontario in 2006
740 116 ha
Lake Superior
Lake Huron
N
Kilometres
0 50 100 200 300

Figure 2.8 Area of jack pine budworm moderate-to-severe defoliation in Ontario, 2006.

the larger and more severe areas of infestation were located in the Lower Manitou, Meggisi and Eltrut Lakes areas, on the east side of Otukamamoan Lake, to the area west of Clearwater West Lake and along Highway 502. Areas of defoliation were mapped from the Bergland area near Lake of the Woods in the west to the Agnes and Kawnipi Lakes area of the eastern part of Quetico Provincial Park. In the southern part of the district there were spots of infestation near the border of Minnesota close to the towns of Emo and Fort Frances and near Rainy Lake, Namakan Lake and Thompson Lake. In addition to the areas of moderate and severe defoliation there were also 8,459 ha of light defoliation mapped in Fort Frances District.

In 2005, there was only 1,134 ha of damage in the Kenora District but this increased to 248,843 ha in 2006. In the Lake of the Woods area, there were infested areas on Big Island, and most of the Aulneau Peninsula was severely defoliated. There were numerous areas of infestation east of Highway 71 from Nestor Falls to Highway 11 including most of the jack pine stands in the areas of Dogtooth, Highwind, Hillrock, Dryberry, Atikwa and Kakagi Lakes. North of Highway 17 there were large areas of infestation around Silver Lake and Black Sturgeon Lake, extending to the Redditt area on the Canadian National Railway line. Isolated pockets of damage occurred as far north as the south end of Separation Lake and as far west as Noyon Township near the Manitoba border. There were also 8,045 ha of light defoliation mapped in Kenora District.

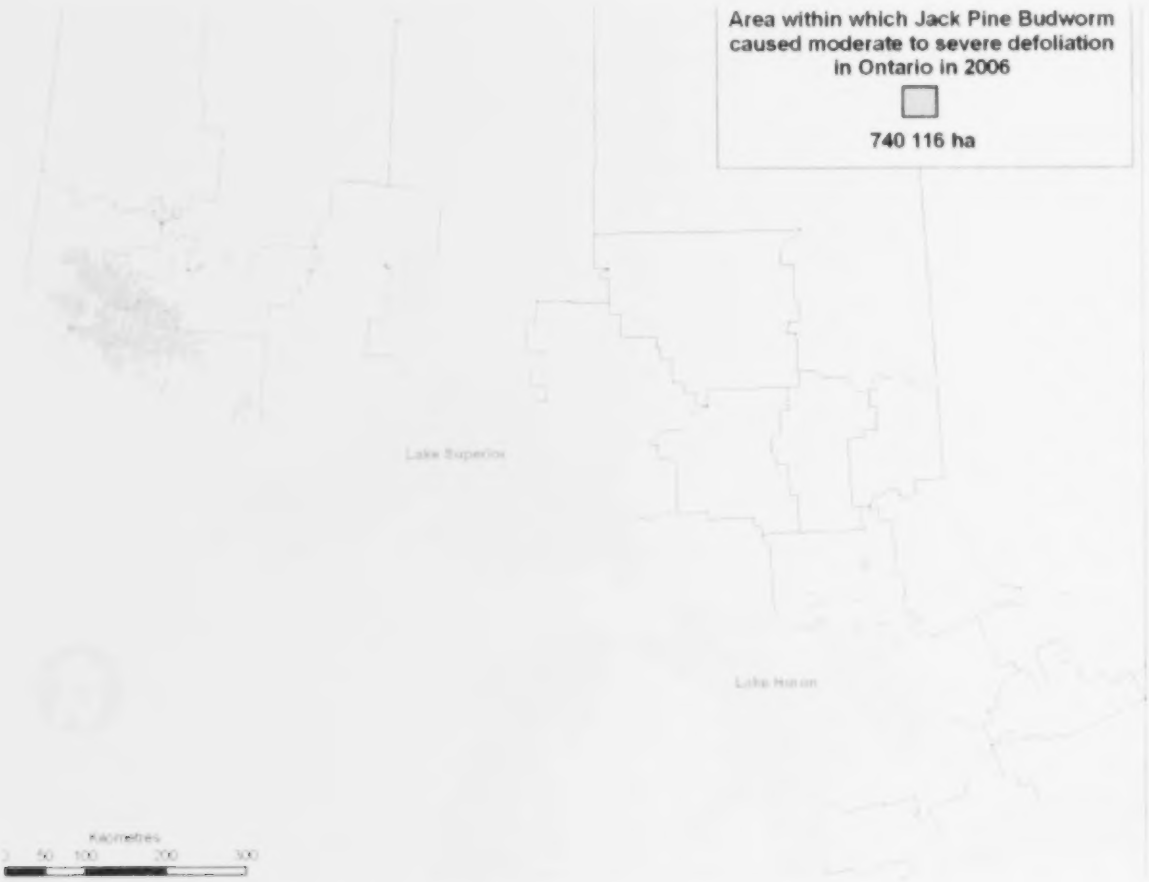
Area within which Jack Pine Budworm caused moderate to severe defoliation in Ontario in 2006
740 116 ha
Lake Superior
Lake Huron
Kilometres
0 50 100 200 300

Figure 2.8 Area of jack pine budworm moderate-to-severe defoliation in Ontario, 2006.

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The majority of the severe infestation in Dryden District occurred in the southwest portion of the district. Much of this was south of Highway 17. Jack pine stands surrounding Manomin, Teggau and Hawkcliffe Lakes were severely defoliated as well as stands further south around Upper Manitou Lake. Moderate damage prevailed in the vicinity of Boyer Lake and there were scattered areas of moderate and severe defoliation in the Eagle Lake area. East and north of the Town of Dryden there were several areas of moderate and light defoliation. Notable locations of defoliation were in Stokes, Drope and Brownridge townships. An isolated pocket of moderate defoliation was mapped as far east as Revell Township on both sides of Highway 17. Numerous scattered locations of light defoliation were reported with one area as far north as Bailey Lake in Breithaupt Township.

Elsewhere in the region, a small area of light infestation was recorded in Echo Township, Sioux Lookout District. In the Thunder Bay District low levels of defoliation were reported at the Kakabeka Falls jack pine seed orchard and on the former MNR tree nursery property within the city of Thunder Bay.

In the Northeast Region areas of defoliation also increased but not to the same extent as the northwest. Here, the total area increased from 3,552 ha in 2005 to 14,989 ha in 2006. The infestation is still confined to Sault Ste. Marie and Sudbury districts within the Northeast.

Sudbury District experienced a substantial increase in affected areas with 14,038 ha of moderate-to-severe defoliation in 2006 compared to 2,599 ha in 2005. There was general expansion of the area infested around Espanola. Some of this area has been affected for three years now and some tree mortality is evident. The moderate defoliation near Nairn Centre in 2005 intensified to severe in 2006. The infestation on Great La Cloche Island doubled in size and the pocket of defoliation on La Cloche Peninsula also increased. Newly infested areas were reported north of Espanola near Agnew Lake and southeast of Whitefish Falls, east of Highway 6. The infestation has also been in the Capreol and Hanmer area of the Sudbury District for three years. Population levels increased here as did the area of damage which extended north of Capreol. A new area of infestation occurred west of the Town of Falconbridge. A small patch of light-to-moderate defoliation also occurred along Highway 17 west of the town of Wahnapitae. South of the city of

Figure 2.9 Defoliation by jack pine budworm in northwestern Ontario (photo by M. Francis).

Sudbury, new areas of infestation occurred between Wavy and White Oak Lakes and along the north shore of Georgian Bay east of Beaverstone Bay.

In Sault Ste. Marie District of Northeastern Ontario, the area of defoliation recurred in the same locations as 2005. These were located in Sagard Township north of Elliot Lake and in Mack Township, north of Blind River. The total area affected here was 951 ha in 2006, similar to the 953 ha in 2005.

There were newly infested areas along the eastern shoreline of Georgian Bay in the Southern Region. This marks the first time since 1996 that defoliation has occurred in the Parry Sound District. Two large pockets were detected on both sides of Highway 69 in the Britt area. In the same vicinity, smaller areas were mapped north of Key River and west of the Canadian National Railway in Wallbridge Township. The area affected in Parry Sound District in 2006 was 4,548 ha. Also in the Southern Region, jack pine budworm was reported in Pembroke District. The infestation persisted along Highway 62 in the Township of Laurentian Valley and a new area was recorded near Bonnechere Provincial Park, which includes the Townships of Killaloe, Hagarty and Richards; affecting a total area of 407 ha in Pembroke District.

Jack pine budworm spray program

The jack pine budworm defoliation in 2005 in the Northwest Region prompted an insect pest management program in 2006. The program was developed by an interdisciplinary team comprised of MNR district, regional and Forest Management Branch staff, representatives of sustainable forest licensees and representatives of local citizens committees. The majority of the program consisted of an insecticide spray program using the biological insecticide *Bacillus thuringiensis var. kurstaki* [*Btk*]. The larvae of the jack pine budworm must ingest the insecticide on the jack pine needles to be effective.

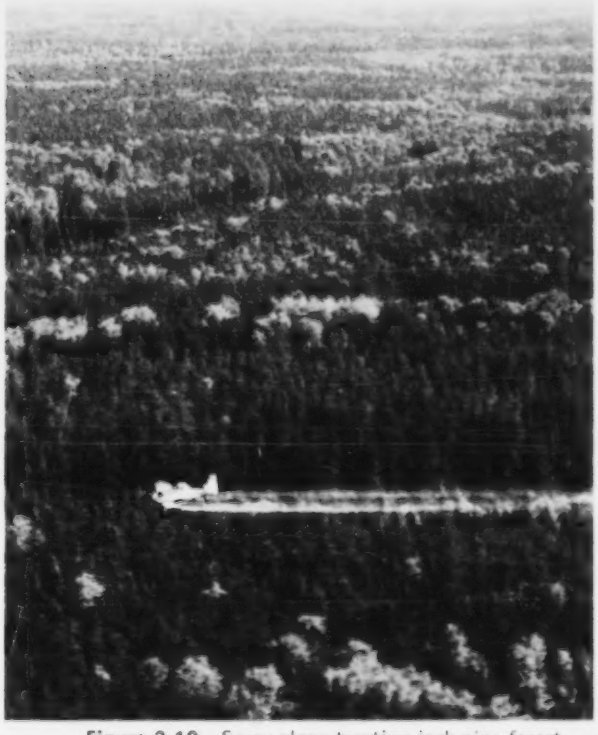

Figure 2.10 Spray plane treating jack pine forest with Btk, a biological control used to target the jack pine budworm (photo by T. Scarr).

Fort Frances Municipal Airport was used as the operations base for the 2006 aerial spray program. There were 14 spray planes used to treat 109,131 ha of infested jack pine stands in the Fort Frances, Kenora and Dryden districts. Twelve aircraft were M-18/M-18A Dromaders and the remaining two were 802 Air Tractors. Spraying started June 1st

and was completed by June 11th. The goal of the spray program was to keep treated areas alive and healthy and reduce top kill and tree mortality. The goal was not to eliminate but to limit defoliation in high-value stands important to timber supply, wildlife habitat, or fire management objectives consistent with forest management plans. The objective set by the pest management planning team was to keep defoliation in treated stands below 40%. Protection and spray deposit was very good in the blocks assessed. Defoliation in sprayed areas averaged 37%, meeting management objectives, while control areas averaged 72% defoliation (Figure 2.11). Assessments also revealed spray deposit on 99% of the foliage sampled.

The treatment was timed to coincide with most of the budworm larvae being in the third or fourth instar. Stands selected for spraying were generally at least 40 years old, with at least 40 % jack pine forecasted to receive moderate-to-severe defoliation in 2006, and important in the short-term wood supply. A few of the stands selected that were younger than 40 years had received significant investment through silviculture treatment and were considered high-value, susceptible stands.

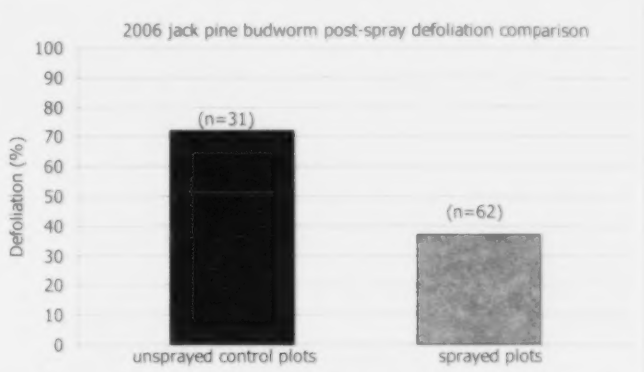

Figure 2.11 Comparison of defoliation severity in sprayed and unsprayed areas of the jack pine budworm infestation in northwestern Ontario, 2006.

Jack pine budworm forecast for 2007

The majority of the life cycle of the jack pine budworm is spent as an overwintering, second instar larva (L2) in silken shelters (hibernaculae) under bark and branch scales from August until the following spring. This stage of its life cycle provides the opportunity to sample branches, extract the larvae and count them to forecast the severity of defoliation for the following spring and summer. This L2 survey is used in decision-making for an insect pest management program.

To forecast jack pine budworm defoliation in 2007, L2 surveys were completed at 375 locations throughout the province in the fall of 2006. Locations were selected in and around the current infestation as well as areas that historically had jack pine budworm defoliation. Locations also included high value areas as identified by sustainable forest licensees. Ten jack pine trees were selected at each location and a one metre branch was sampled from the mid-to upper-crown of each tree. Each branch was rated for defoliation and sent to a lab where the branches were processed in a sodium hydroxide washing procedure to force the second instar larvae from their hibernaculae for counting. Larvae were then collected and counted under a microscope to determine the

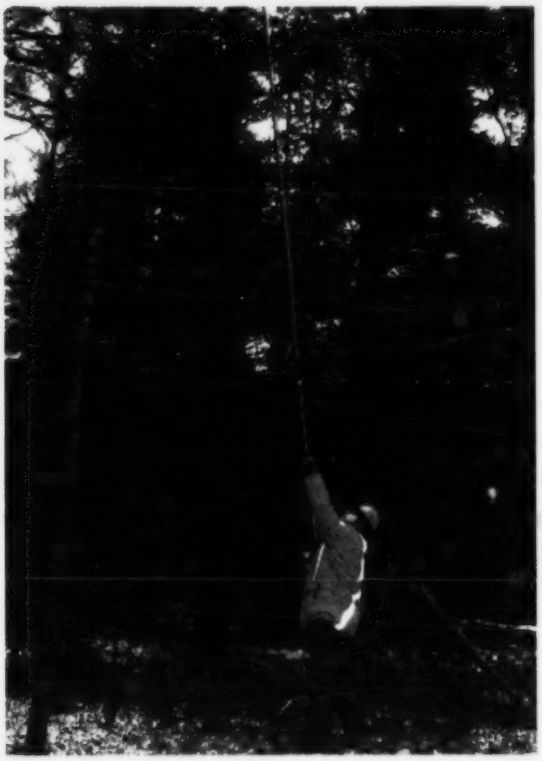

Figure 2.12 Branch collection for second instar larvae (L2) sampling (photo by M. Francis).

average number of jack pine budworm per branch for each location. This average was used to forecast the expected defoliation in 2007. An average of more than 54 larvae per branch forecasts a severe defoliation for that location. Moderate defoliation is forecasted for 16 to 54 jack pine budworm per branch and light defoliation can be expected for 15 or fewer larvae per branch.

In the Northwest Region, a total of 271 locations (2,710 trees) were sampled in 2006. Severe defoliation was forecast for 15 locations, 75 locations had a moderate forecast, and 179 locations had a light forecast for 2007. The remaining 2 locations had no defoliation forecasted for 2007 since there were no larvae present.

Fort Frances District had the most locations sampled, but the majority (76%) of these had a light defoliation forecast for 2007. Moderate-to-severe forecasts occurred primarily in the north central portion of this district.

Kenora District had a total of 61 locations sampled and over 50% had a moderate or severe defoliation forecast (moderate – 25 locations, severe – 8 locations) for 2007. Most of these locations were in the southeast and central part of the district. The northern and western parts of the district had light defoliation forecasts for 2007.

Dryden District had 55 locations sampled in 2006; almost 50% of them had a moderate or severe defoliation forecast for 2007. Moderate-to-severe defoliation is expected in the western half of the district in 2007. Light defoliation forecasts were recorded in the southeastern part of Dryden District.

Red Lake, Sioux Lookout and Thunder Bay districts can expect very little defoliation in 2007 with the exception of the very south western part of Sioux Lookout District with one moderate defoliation forecast.

In the Northeast Region, where the jack pine budworm infestation has remained small relative to that of the Northwest, a total of 92 locations (920 trees) were sampled in 2006. The bulk of the sampling was in Sudbury District where this defoliator has caused defoliation in the 1980s and 1990s. In 2006, a total of 50 locations were sampled in Sudbury District. Light or nil defoliation is forecast for 44 sites for 2007. Based on sampling, moderate-to-severe defoliation is forecasted to persist in 2007 in the Espanola and Capreol areas.

The trend is expected to remain the same in Sault Ste. Marie District in Sagard Township where moderate-to-severe defoliation is likely to occur again in 2007. Sagard Township

Table 2.4 Jack pine budworm defoliation forecasts for Ontario in 2007.

Region / District	Total Locations Sampled	2007 DEFOLIATION FORECAST (NUMBER OF LOCATIONS) Nil	Light	Moderate	Severe
Northwest					
Fort Frances	123	0	94	27	2
Kenora	61	0	28	25	8
Dryden	55	0	28	22	5
Red Lake	12	1	11	0	0
Thunder Bay	11	1	10	0	0
Sioux Lookout	9	0	8	1	0
Northeast					
Sudbury	50	15	29	2	4
Sault Ste. Marie	21	4	11	5	1
Chapleau	13	8	5	0	0
Timmins	7	3	4	0	0
North Bay	1	0	1	0	0
Southern					
Pembroke	8	4	4	0	0
Parry Sound	4	0	4	0	0

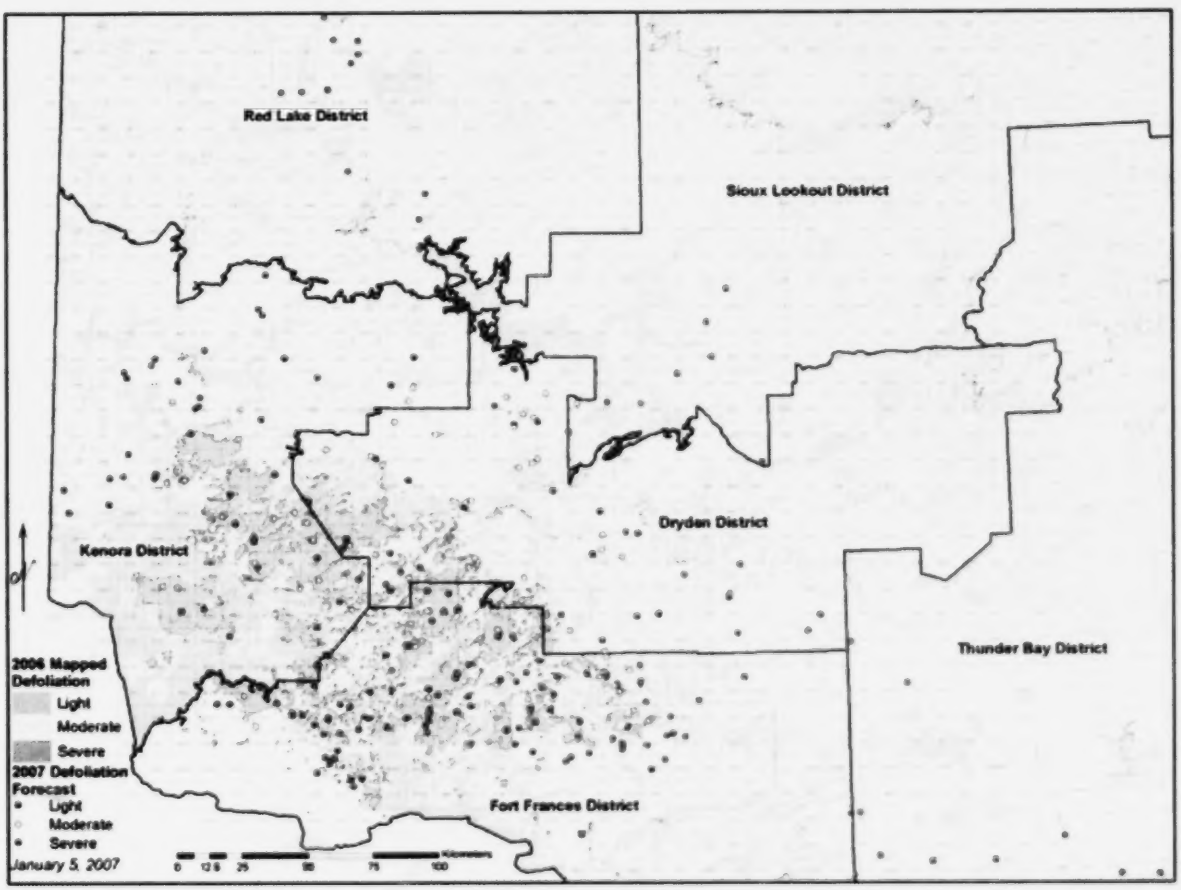

Figure 2.13 L2 sampling locations showing 2007 defoliation forecasts and 2006 defoliation in the Northwest Region.

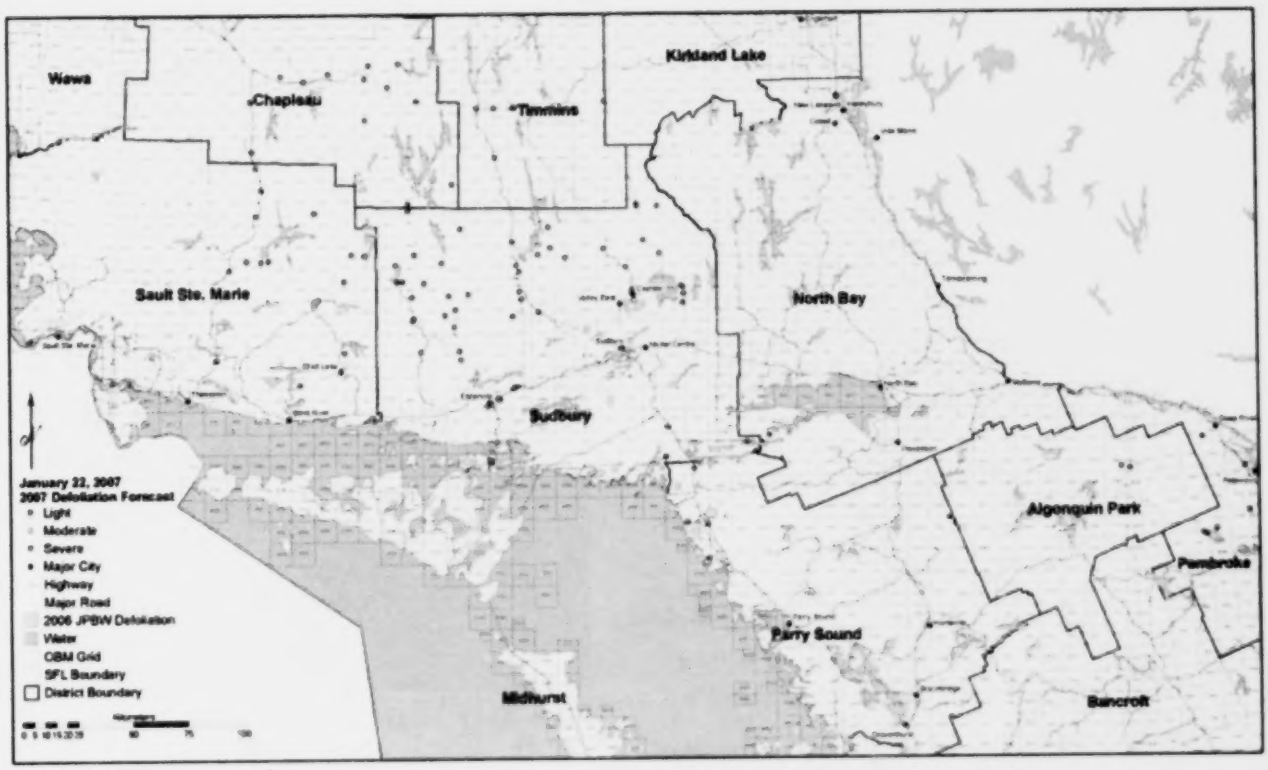

Figure 2.14 L2 sampling locations showing 2007 defoliation forecasts and 2006 defoliation in the Northeast and Southern regions.

has been a hot spot in the last couple of jack pine budworm outbreaks. There was moderate defoliation near Lake Matinenda in 2006, but the L2 survey forecasts light defoliation in 2007.

Remaining defoliation forecasts in Sault Ste. Marie District indicate light or no defoliation for the other areas sampled. In addition, defoliation forecasts indicate very light or no defoliation in Chapleau, Timmins and North Bay districts for 2007.

In the Southern region jack pine budworm has historically reached outbreak levels in Parry Sound and Pembroke districts. Three small pockets of moderate-to-severe defoliation were mapped in Parry Sound District in 2006, but L2 surveys are forecasting light defoliation in these areas for 2007.

A small area in Fraser Township in Pembroke District had moderate to severe defoliation in 2005 and 2006, but L2 surveys also forecast light defoliation for this area in 2007.

Jack pine forest health assessment

In the mid-1990's, jack pine plots were established across northeastern and northwestern Ontario to monitor and study the impacts of jack pine budworm. In 2000, these plots were converted to 'jack pine forest health plots' to monitor the health of jack pine stands across northern Ontario. These permanent sample plots are monitored by forest health field staff, independent of any current jack pine budworm infestation.

In Ontario in 2006, a total of 133 plots (6,650 trees) were rated for the occurrence of pest, disease or abiotic factors affecting jack pine as well as the abundance of male flowers (Tables 2.5 - 2.8). In northeastern Ontario there are 65 plots and in northwestern Ontario there are 68 plots.

In 2006 jack pine tree condition was similar in both northeastern and northwestern Ontario (Table 2.5). The majority of trees sampled had less than 25% defoliation of old and current foliage or between 25 - 50% total defoliation. Higher levels of defoliation were recorded in northwestern Ontario due to the large expanse of the jack pine budworm infestation. New mortality was slightly higher in northwestern Ontario in 2006, but overall cumulative mortality of jack pine was higher in the northeast.

Figure 2.15 Jack pine budworm flowers (photo by M. Francis).

The tops of the jack pine trees are relatively healthy in both regions of northern Ontario and the surveys revealed lighter male flower levels in northwestern Ontario (Table 2.6). The recent jack pine budworm outbreak may have triggered some trees to reduce male flower and pollen production.

Table 2.5 Condition of all trees rated in jack pine forest health plots.

	Tree Condition								
	Total Defoliation							Dead	
Region	None	Only current <25%	Current and old <25%	25-50%	51-75%	76-90%	>90%	New	Old
NE	0.3	0.0	57.5	12.4	1.4	0.3	0.1	1.1	26.9
NW	4.7	0.1	47.2	16.9	4.0	2.6	2.0	2.2	20.3

Table 2.6 Condition of tree tops and abundance of flowers of all trees rated in jack pine forest health plots.

	Tree Condition						
	Top			Flowers			
Region	Live	Bare	Dead	Nil	Light	Moderate	Heavy
NE	98.3	0.3	1.3	3.0	22.0	24.0	51.0
NW	98.0	0.5	1.5	20.0	35.0	20.0	25.0

Western gall rust caused light-to-moderate damage on 13% of all the trees assessed in the Northeast while only 6% of all the trees evaluated in the Northwest had this disease (Table 2.7). Drought played a factor in the health of the jack pine in the Northwest Region; 35% of all trees evaluated had light-to-moderate damage caused by the hot, dry summer of 2006.

Table 2.7 Percentage of trees affected by western gall rust and drought for all trees rated in jack pine forest health plots.

Pest/Damage			
Western Gall Rust		Drought	
Trees affected (%)	Average level of damage	Trees affected (%)	Average level of damage
13	Light to moderate	0	0
6	Light to moderate	35	Light to moderate

Jack pine budworm defoliation was found in 10 plots in the Northwest Region and two plots in the Northeast Region (Table 2.8). Within these plots, jack pine budworm defoliation averaged 71% in Northwest Region and 28% in Northeast Region.

Table 2.8 Percentage defoliation in jack pine forest health plots within the area of the current jack pine budworm infestation.

	Jack pine budworm	
Region	No. of Plots affected	Average current defoliation (%)
NE	2	28
NW	10	71

Forest tent caterpillar, *Malacosoma disstria* Hbn.

The current outbreak of forest tent caterpillar peaked in 2001 when there were over 13 million hectares infested with extensive areas of defoliation in all three regions. Since then there has been a decline in the infested area. In 2006, there were 370,759 ha of moderate-to-severe defoliation on poplar (*Populus* spp.) and birch, (*Betula* spp.) hosts with other hardwood species affected to a lesser extent. This occurred mostly in Sudbury District, with smaller areas in North Bay District, of the Northeast Region and in Parry Sound District of the Southern Region. This represents declines in defoliated area for Sudbury and North Bay districts but an increase in Parry Sound District (Table 2.9 and Figure 2.17).

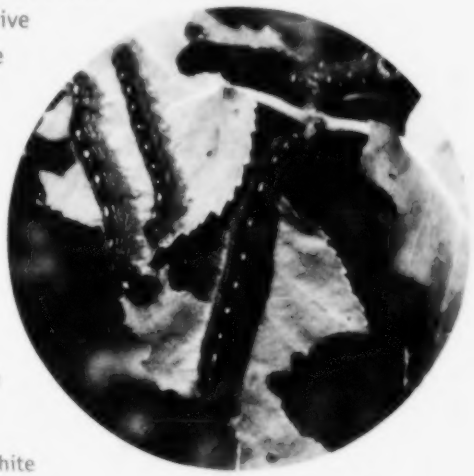

Figure 2.16 Forest tent caterpillar larvae feeding on white birch (photo by D. Rowlinson).

Table 2.9 Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in Ontario, 2003 - 2006.

Region / District	Area (ha)			
	2003	2004	2005	2006
Northwest				
Fort Frances	6 345	0	0	0
Nipigon	857 302	583 505	0	0
Thunder Bay	1 893 982	22 991	0	0
	2 757 629	606 496	0	0
Northeast				
Hearst	141 690	29 223	0	0
Kirkland Lake	418 379	2 549	0	0
North Bay	318 330	143 239	28 501	4 946
Sault Ste. Marie	26 549	0	0	0
Sudbury	608 301	458 767	435 399	355 532
Timmins	155 477	3 459	0	0
	1 668 726	637 237	463 900	360 478
Southern				
Midhurst	2 798	1 915	0	0
Parry Sound	60 889	31 886	5 932	10 281
	63 687	33 801	5 932	10 281
TOTAL	4 490 042	1 277 534	469 832	370 759

In the Sudbury District the area of defoliation was 355,532 ha compared with 435,399 ha in 2005. The main body of the infested area was through the south-central part of the district similar to 2005. The defoliated area covered a large swath from the Espanola area northeast almost to Lake Wanapitei, with the northern and southern boundaries near Levack and Lake Panache, respectively. Fingers from the large outbreak extended east to the West Bay area of Lake Nipissing and south along Highway 69 almost to the French River.

In North Bay District the area of defoliation was 4,946 ha compared with 28,501 ha in 2005. The remaining areas of infestation occurred just north of the town of Sturgeon Falls and in the Cache Bay area, West Nipissing and south of Lake Nipissing in Hardy and Patterson townships.

The area of defoliation increased from 5,932 ha (2005) to 10,281 ha this year in the Parry Sound District. Three separate pockets of damage were mapped. The largest was in McConkey Township with others in McKenzie Township and Ferrie and Lount Townships.

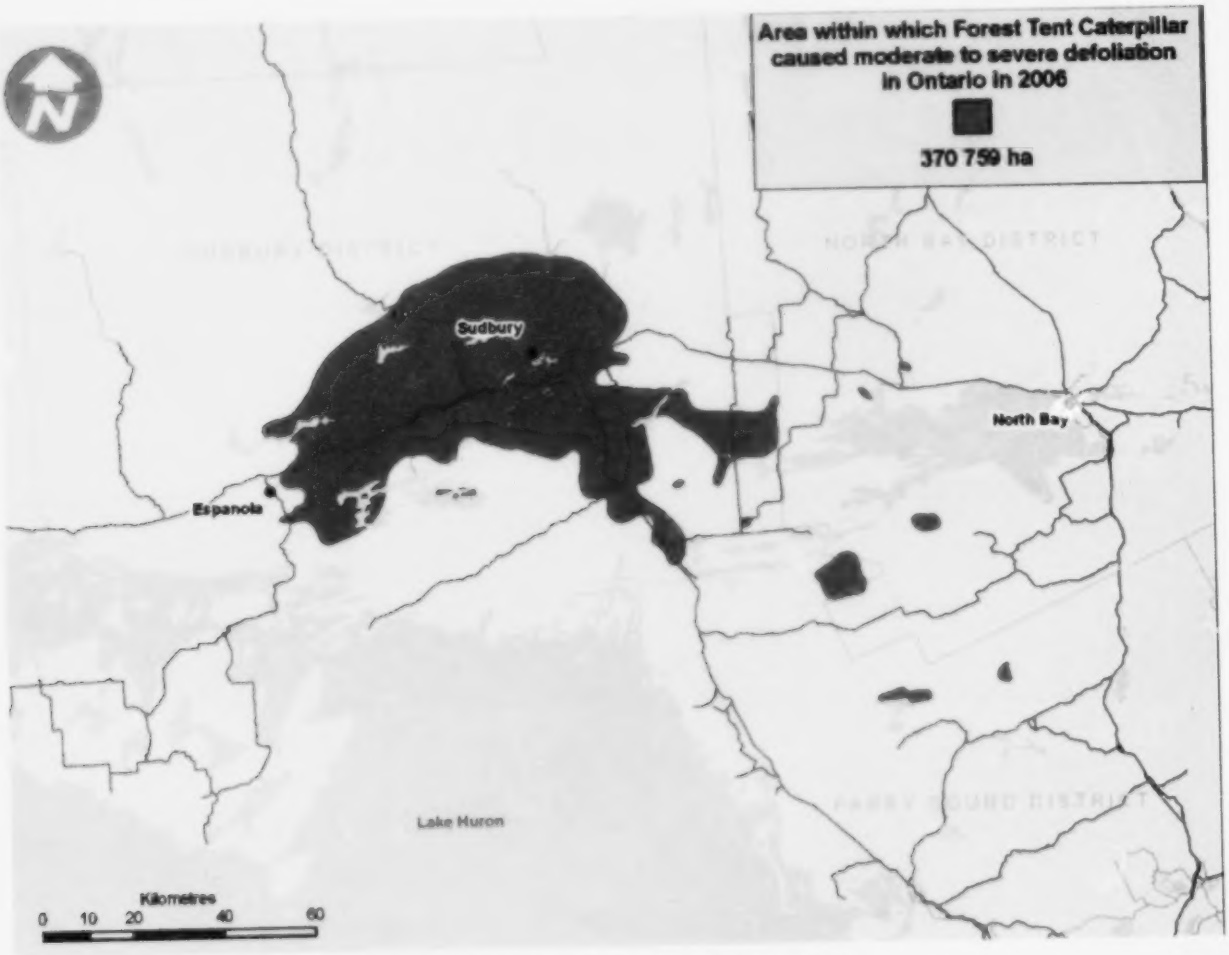

Figure 2.17 Area of forest tent caterpillar defoliation in Ontario, 2006.

Invasive Species in Ontario's Forests

E. J. Czerwinski[1], L. Tucker[1], H. J. Evans[2], W. D. Biggs[2], and D. T. Rowlinson[1]

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FOREST INSECTS

Pine false webworm, *Acantholyda erythrocephala* (L.)

Pine false webworm has been established for many decades in Ontario and preferentially feeds on older needles. Pine false webworm damaged a total of 286 ha of eastern white pine, *Pinus strobus* in 2006, all of which occurred in Midhurst District, Southern Region. This represents a 60% reduction from 2005 when 732 ha were defoliated and a 98% reduction from the peak of 8 992 ha recorded in Ontario in 1997. Similar to 2005, most of the damage was recorded in plantations of eastern white pine with the majority of pine stands infested in Grey County, and lesser amounts recorded in Bruce and Simcoe counties (Table 3.1).

In Grey County, the area infested totaled 277 ha at approximately 30 different locations. The areas infested were mostly in the Township of Chatsworth, north of Holland Centre; east of Desboro; near McCullough Lake; near Holford; and in the Kinghurst area. Adjacent to this last area were affected stands in West Grey Township and areas east of the Town of Durham. There was also a single area of damage in Southgate Township (Figure 3.1). Low populations were noted in formerly heavily infested areas of the Township of Chatsworth and Grey Highlands, Lily Oak and Harkaway, Grey County forest tracts.

In Bruce County there were three locations of moderate-to-severe damage detected which totaled 9 ha in 2006. These were in eastern white pine plantations between

Table 3.1 Gross area of moderate-to-severe defoliation caused by the pine false webworm in Ontario 2002 – 2006.

District	Area of defoliation (ha)				
	2002	2003	2004	2005	2006
Bancroft	0	16	16	0	0
Midhurst	2 006	737	1 100	691	286
Peterborough	0	65	91	41	0
Total	2 006	818	1 207	732	286

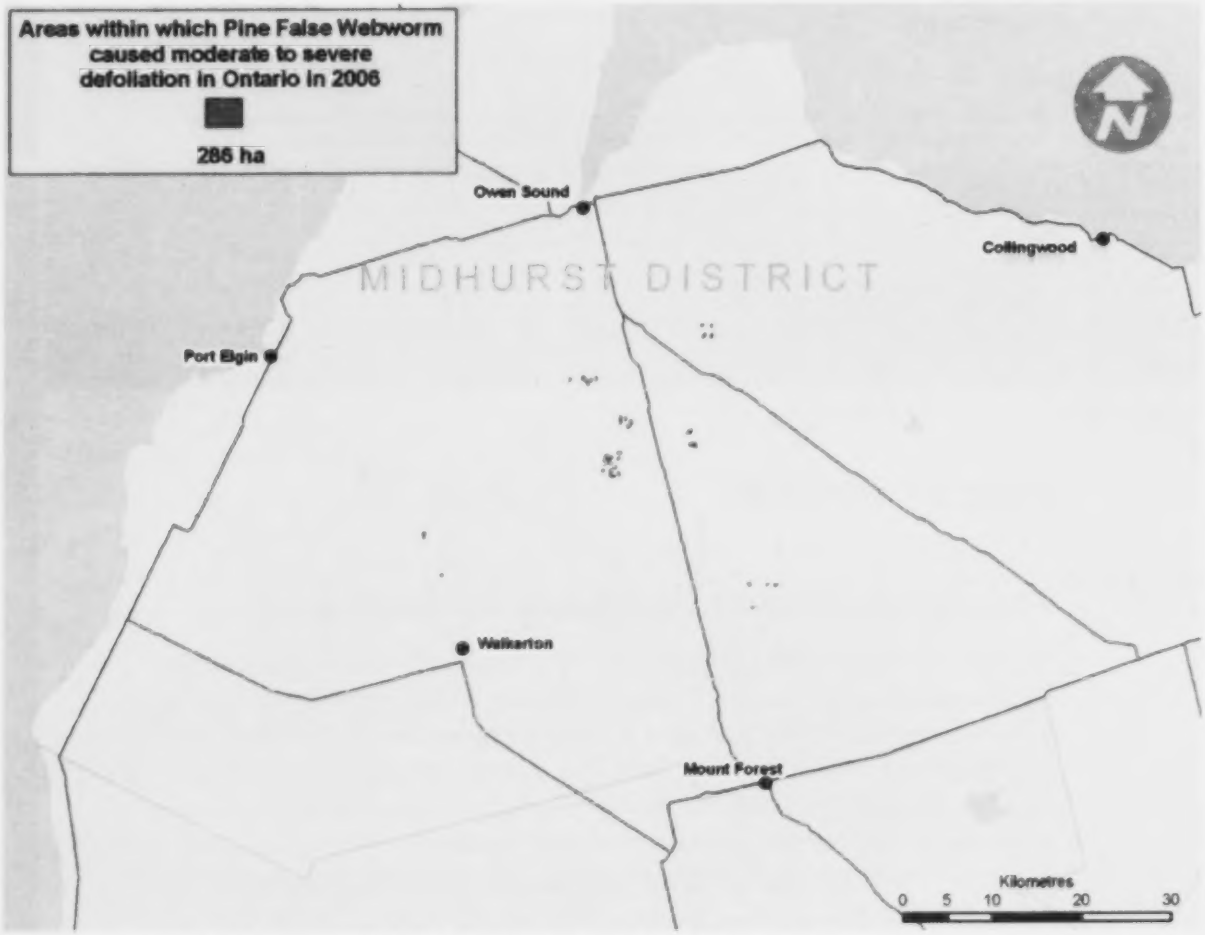


Figure 3.1 Areas within which pine false webworm damage occurred, 2006.

Walkerton and Paisley in the Municipality of Brockton (formerly Brant Township). There was only a single area infested in Simcoe County. This occurred on the Drury Tract of Simcoe County forest near Edgar in Oro-Medonte Township. At this location mature eastern white pine trees were affected on approximately 10 ha of forest land.

Reasons for reductions of the pine false webworm in 2006 are unclear. Feeding appeared to be less intense this year yet often resulted in 100% defoliation of the two-year old foliage. As a result of attacks in previous years, the current year's foliage and developed shoots were stunted resulting in fewer needles for the pine false webworm in which to construct a nest.

There were several other reports of pine false webworm elsewhere in the province: red pine, Pinus resinosa Ait. and jack pine were lightly defoliated near Kakabeka Falls, Thunder Bay District; red and eastern white pine were heavily defoliated in a small pocket near Laughing Water Park on the Garden River IR, Sault Ste. Marie; moderate defoliation was reported in Westmeath Township, Pembroke District; and defoliation was recorded at light-to-moderate levels on understory red pine in the Ganaraska Forest of Peterborough and Aurora districts.

Asian long-horned beetle, *Anoplophora glabripennis* (Mots.)

The Asian long-horned beetle is a destructive wood boring insect from Asia found in an industrial park bordering Toronto and the City of Vaughan in 2003. This was the first confirmed infestation in Canada. It was likely introduced into North America by way of wooden pallets, crates, or packaging materials used in shipping. Millions of dollars have been spent to eradicate the insect. Though these programs have been successful to date, any new sightings require immediate action. The Canadian Food Inspection Agency (CFIA) is recognized as the lead agency for dealing with invasive alien insects. Since the initial find, the CFIA has been conducting visual surveys to determine the extent and severity of the infestation. A regulated containment zone has been established in the border area between Toronto and Vaughn and there is a tree removal program for any infested area in an effort to eradicate this insect. For more information on Asian long-horned beetle visit the Canadian Food Inspection Agency website: www.inspection.gc.ca or contact the CFIA at 1-800-442-2342.

Emerald ash borer, *Agrilus planipennis* Fairmaire

The emerald ash borer is an exotic buprestid beetle from Asia that is believed to have been in Canada since approximately the year 2000. It is capable of feeding on and killing all species of ash trees found in Canada. Adult beetles will feed on the leaves, while the larvae will feed on the cambium layer underneath the bark which eventually girdles the tree and kills it.

The emerald ash borer was first detected in Ontario in the City of Windsor in 2002 by MNR-CFS Forest Health staff. Since then, populations have been found throughout Essex County and in portions of the Municipality of Chatham-Kent, St. Clair Township; Lambton County, the Municipality of Dutton/Dunwich; Elgin County, and most recently in the City of London, Middlesex County, Aylmer District. It is believed that this most recent find in London is as a result of the movement of infested material as opposed to natural dispersal of this insect. The emerald ash borer and ash material are regulated by the Canadian Food Inspection Agency (CFIA), Plant Quarantine Division. Areas regulated by the CFIA now include Essex County, Municipality of Chatham-Kent, Lambton and Middlesex counties and parts of the City of London (Figure 3.2).

This insect is now well established in several locations outside of Essex County, however contiguous landscape level damage remains confined to Essex County and the

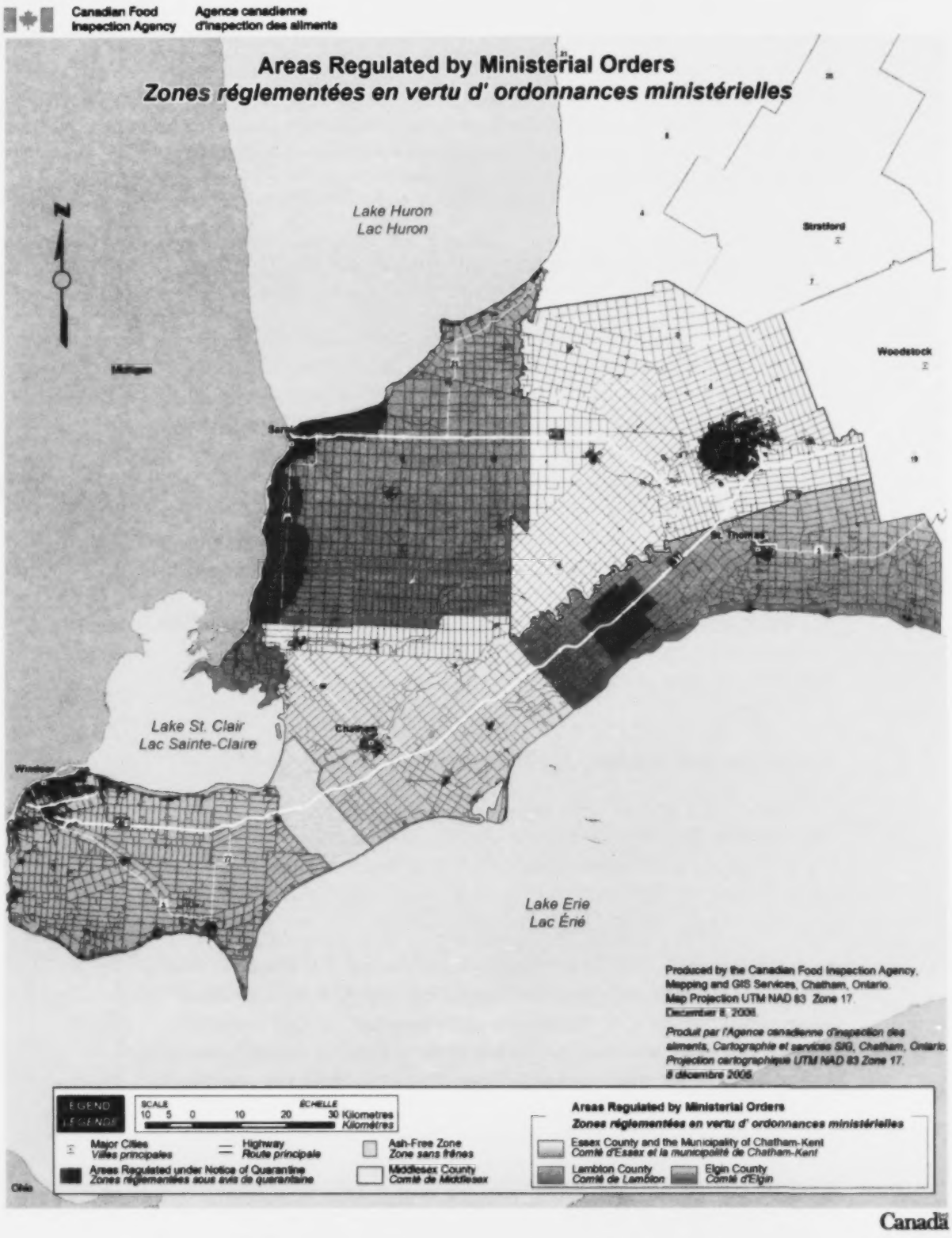
Figure 3.2 Areas regulated for emerald ash borer by the Canadian Food Inspection Agency, 2006.

western portion of the Municipality of Chatham-Kent. Here, thousands of ash trees are either dead or declining due to this insect. In 2004, aerial reconnaissance mapped 1,092 ha of forest damage. That increased to 1,985 ha in 2005. In 2006, the total area of forest damage by EAB more than doubled to 4,389 hectares (Figure 3.3).

To quantify the damage caused by the emerald ash borer, 25 plots were established in 2004 in Essex County to rate the overall vigour of ash trees. A standard hardwood rating protocol for tree vigour was used. Trees within a plot were assigned a health rating on a scale from 1-5, where 1 represents a healthy tree and 5 represents a dead tree. An average health rating per plot is then determined. The overall mean vigour was 3.7 in 2004. Revisiting the plots in 2005 and 2006 found that tree vigour had decreased by 11% to a value of 4.2 in 2005, and a further 14% in 2006 with the mean rating 4.9. This indicates that virtually every ash tree is dead in the original 25 assessment plots.

The emerald ash borer's current impact on the landscape in southern Ontario is significant (Figure 3.4). Damage and mortality from this insect is reducing the ash forest component and cover of an already sparsely forested area. Species of ash are

Figure 3.3 Total area of forest damage by emerald ash borer in Ontario, 2006.



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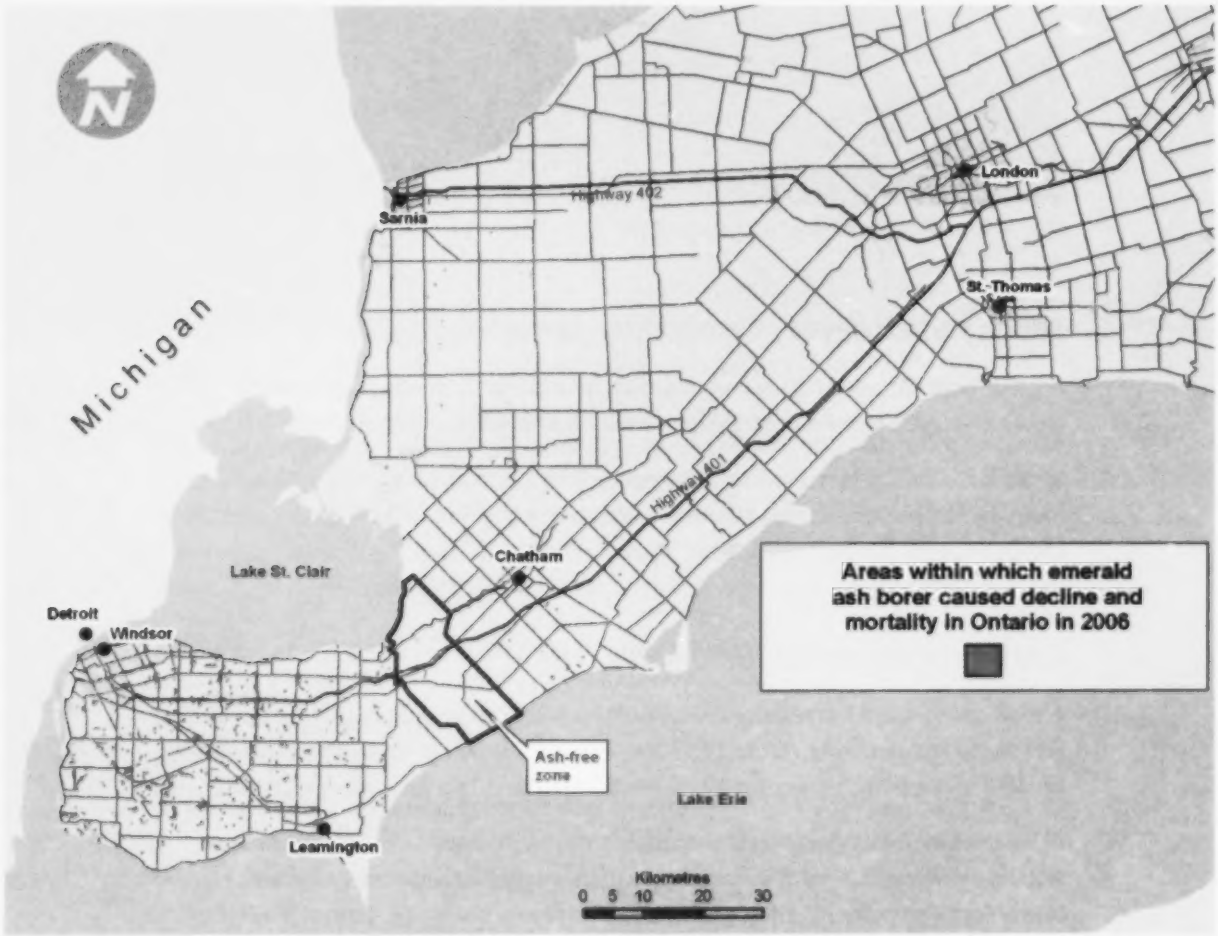


Figure 3.3 Total area of forest damage by emerald ash borer in Ontario, 2006.

significant components in many woodlots and are common in riparian areas. Two native ash species in Ontario are limited to the extreme southwestern part of Ontario. These are pumpkin ash and blue ash, *Fraxinus profunda* (Bush) Bush, and *F. quadrangulata* Michx., respectively. Whereas blue ash appears to be less vulnerable than other ash species to EAB, pumpkin ash is extremely vulnerable to attack. Blue ash is listed as a species of special concern both provincially and federally. Attacks from this insect have the potential of extirpating these two species of ash from the Canadian landscape.

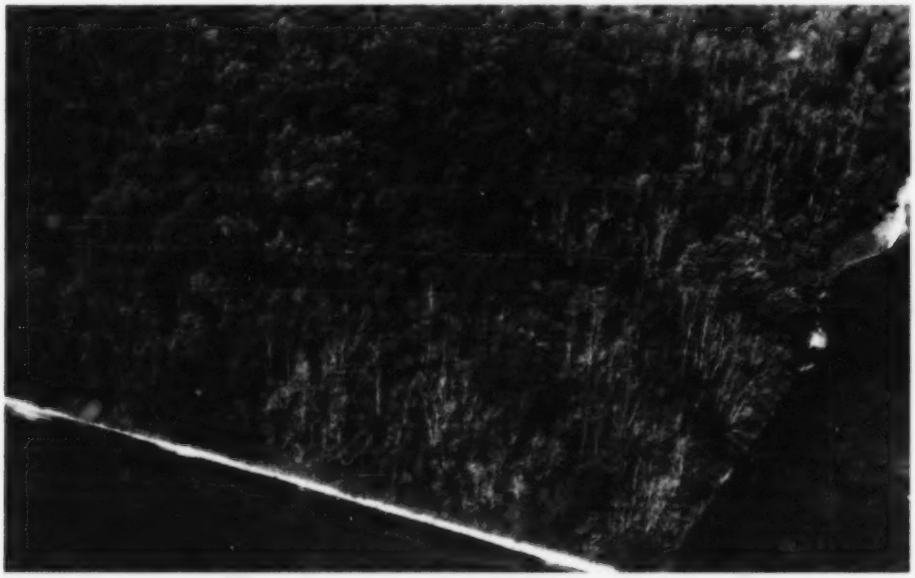


Figure 3.4 Woodlot infested with emerald ash borer (photo by L. Tucker).

Birch casebearer, *Coleophora serratella* (L.)

For the fourth consecutive year, high populations of the birch casebearer caused moderate-to-severe defoliation through Bancroft and Peterborough districts.

White birch trees growing in riparian areas were the most attacked. One of the most heavily infested areas was on the west shore of Lake Kushhog, near Minden, Township of Minden Hills, Bancroft District.

Larch casebearer, *C. laricella* (Hbn.)

A total of 991 ha of heavy defoliation by larch casebearer were aerially mapped in Kemptville and Pembroke districts in 2006 (Figure 3.5). Within these areas, top and whole-tree mortality has occurred as a result of the past two years of infestation.

Defoliation by the larch casebearer continues to persist around Cranberry Lake in Wolford Township; around Mississippi Lake; in Ramsay, Beckwith and Drummond townships; and in the Alfred Bog, Alfred and Caledonia townships, Kemptville District. These infestations have resulted in severe tree mortality to tamarack, *Larix laricina* (Du Roi) K. Koch.

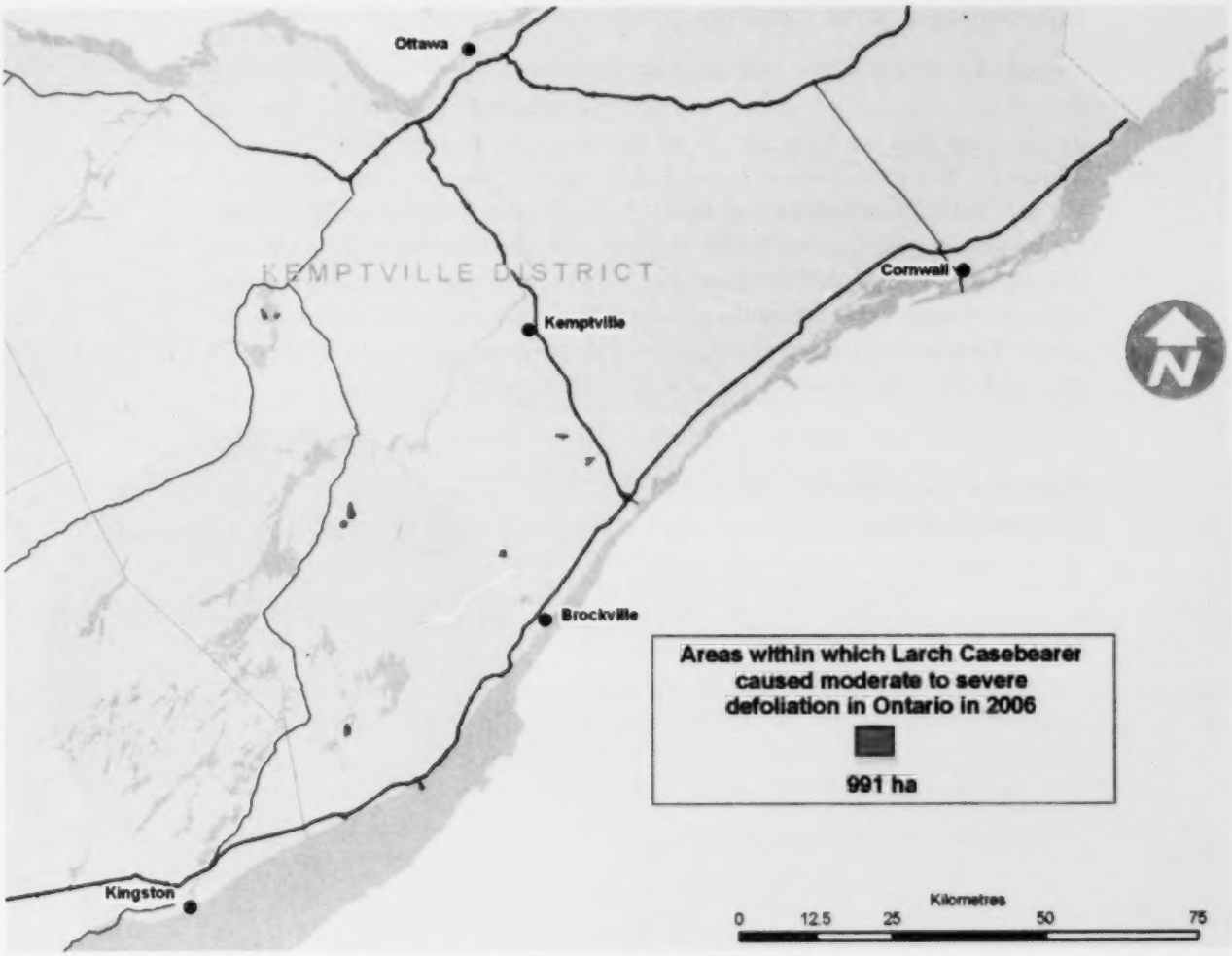


Figure 3.5 Areas within which larch casebearer caused defoliation in 2006.

Significant populations of the larch casebearer have also been recorded in the Pembroke District for the past several years and this has resulted in tree mortality around many lakes. In particular, areas were affected adjacent to Round Lake, Richards Township and Golden Lake, Sebastopol Township. Similar damage has occurred around Dalhousie Lake, Dalhousie Township and Christie Lake, Sherbrooke Township, Pembroke District.

Defoliation by the larch casebearer was recorded at moderate levels in Guelph District and in the Minising Swamp, Springwater Township, Midhurst District. Elsewhere in the region, populations declined to endemic levels after several years of causing moderate-to-severe defoliation.

In the northwest, damage was restricted to the City of Thunder Bay along highway corridors and small wooded areas. Some larch trees had severe defoliation, but overall the damaged areas were moderate in intensity.

Host trees repeatedly defoliated by the larch casebearer are predisposed to attack by the eastern larch beetle, *Dendroctonus simplex* LeC. This beetle is likely the causal factor in further decline and eventual mortality of host trees in the province.

Introduced pine sawfly, *Diprion similis* (Htg.)

Introduced to Canada in 1931, this introduced defoliator has been recorded in Ontario at some level since it was first found in 1970. In 2006 larvae were observed feeding on pines (prefers white and Scots pine) in low numbers on the west side of the City of Thunder Bay and in the towns of Kenora, Fort Frances and Sioux Lookout. Low levels of this pest were also seen on the Highway 71 corridor between Fort Frances and Kenora. The larvae were feeding predominantly on younger eastern white pine and older Scots pine, but a few were found feeding on some young red pine trees. The feeding was very light (<5% defoliation) on all species giving the trees a slightly thinner appearance on some of the branches. The second generation of this pest was seen in larger numbers in late August and early September, but with very little increase in defoliation.

Mimosa webworm, *Homadaula anisocentra* Meyr.

Several colonies of the mimosa webworm were found at various widely-distributed locations in Aylmer District. Defoliation ranged as high as 80% on honey-locust, *Gleditsia triacanthos* L. at sites in Essex, Elgin, and City of Norfolk counties (Figure 3.6). This insect continues an eastward movement across the Southern Region from the original introduction in Essex County.

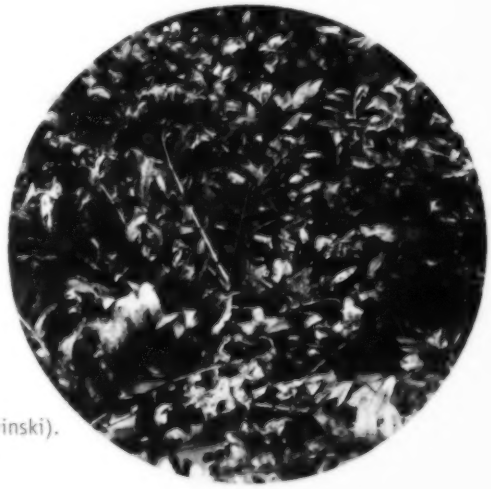
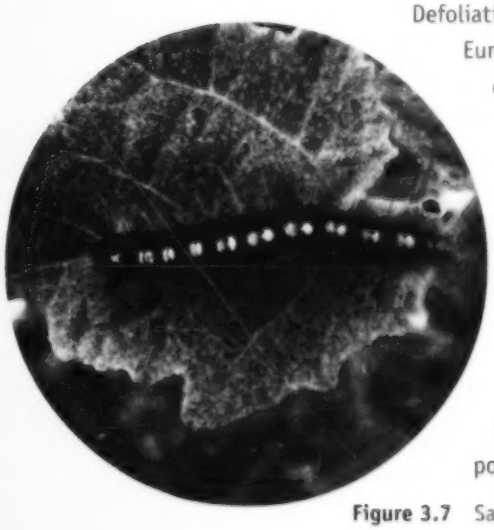


Figure 3.6 Mimosa webworm damage (photo by E. Czerwinski).

Satin moth, *Leucoma salicis* (L.)

Population levels of the satin moth have fluctuated in Ontario in recent years. Increases in population and defoliation have been recorded in the greater Sudbury area, while in the Southern Region, populations have declined to low levels.



Defoliation was observed on various species of poplar, with European white poplar, *Populus alba* L. being the most commonly affected species around the City of Greater Sudbury. Severe defoliation caused by the colourful larvae occurred in clumps of trees in the communities of Falconbridge, Garson and Copper Cliff (Figure 3.7). Populations were also observed defoliating trembling aspen, *P. tremuloides* Michx. growing in a fencerow near Grimsthorpe, Campbell Township, Manitoulin Island, Sudbury District.

Low population levels were detected at a few sites in the southern part of Parry Sound District. Elsewhere populations did not recur in the province.

Figure 3.7 Satin moth caterpillar (photo by D. Rowlinson).

Gypsy moth, *Lymantria dispar* (L)

The total area of defoliation in Ontario by the gypsy moth was 10,309 ha in 2006.

Almost all of this defoliation (10,177 ha) occurred in the Southern Region. Just 132 ha of moderate-to-severe defoliation occurred in the Northeast Region, North Bay District.

In the Northeast Region, oak and white birch trees were once again defoliated on the Manitou Islands in Lake Nipissing. A small localized population of gypsy moth continued to occur in the town of New Liskeard, where it caused light defoliation on bur oak in 2006. In Sudbury District, population levels appear to be on the increase with larvae observed more often within the south central portion of the district.

The 10,177 ha of moderate-to-severe defoliation in Southern Region occurred in several small pockets in Aylmer, Guelph and Aurora districts (Figure 3.8). This was almost 10 times the defoliation which was mapped in Southern Region in 2005 (Table 3.2).

The majority of landscape-level defoliation occurred in the Guelph district ith 8,956 ha of moderate-to-severe defoliation. Defoliation occurred in the Six Nations Indian Reserve, Brant County. Further defoliation occurred in several woodlots northeast of Cayuga, Haldimand County (Figure 3.9). Additional infested woodlots were located

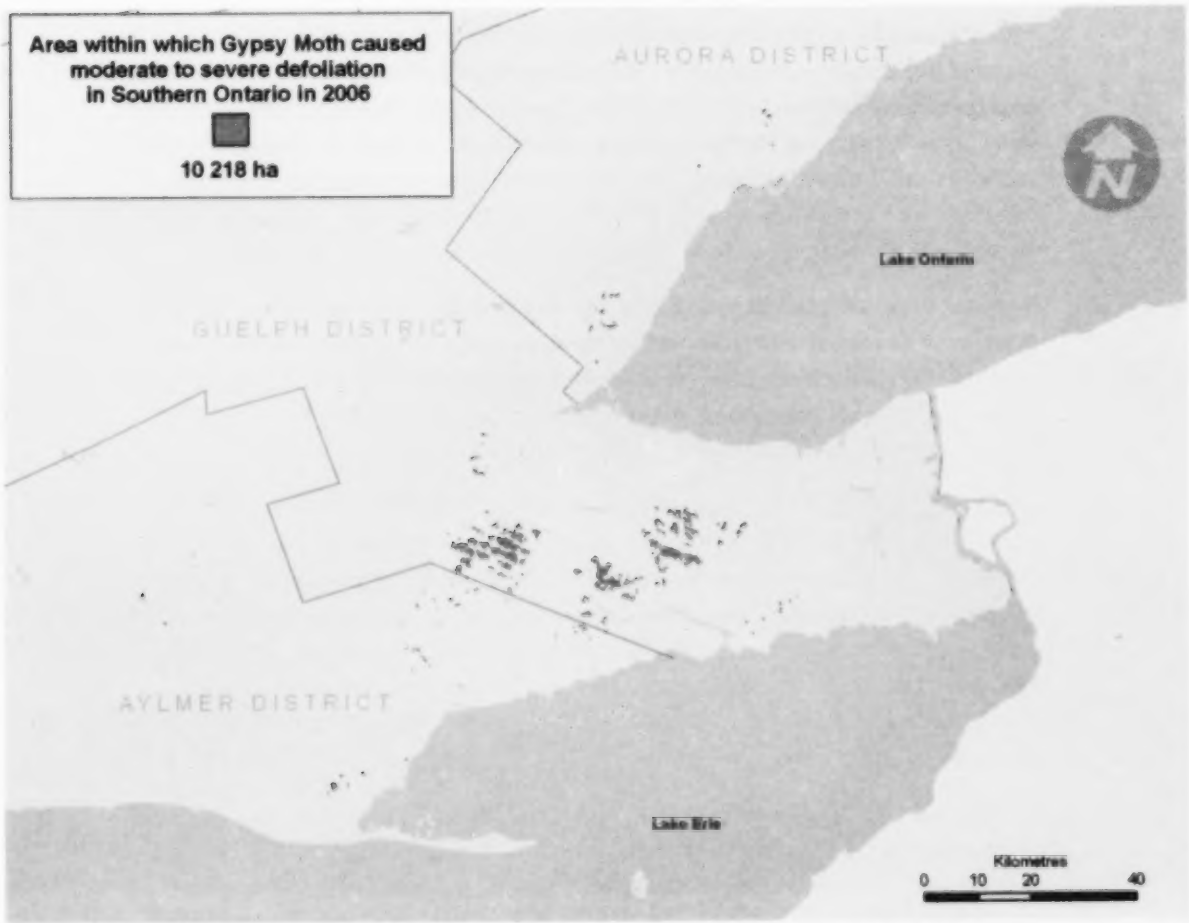


Figure 3.8 Area within which gypsy moth defoliation occurred in Southern Ontario, 2006.

around the border of Haldimand County and the Regional Municipality of Niagara. These areas included several woodlots between the towns of Caistorville, Attercliffe, and Smithville. Defoliation occurred on white oak, *Quercus alba;* red oak, *Q. rubra;* American beech, *Fagus grandifolia;* black cherry, *Prunus serotina;* sugar maple, *Acer saccharum*, and white pine, *Pinus strobus*. Low levels of the fungus *Entomaphaga maimaiga* were documented at a few sites in this district; however infection was not high enough to influence the populations.

Figure 3.9 Gypsy moth defoliation, Haldimand County (photo by L. Tucker).

In Aylmer District, 776 ha of moderate-to-severe defoliation were mapped. This occurred in several woodlots northeast of Simcoe and a few woodlots near St. Williams, Norfolk County. Host trees included white oak, red oak, American beech, black cherry, sugar maple, and white pine. Defoliation also occurred in a few woodlots south of Woodstock, County of Oxford where host trees included sugar maple and American beech.

In Aurora District, 445 ha of damage were mapped. The most severe defoliation occurred in areas along Sixteen Mile Creek south of Burnhamthorpe Road, along Bronte Creek between Dundas and Upper Middle Road, and in some of the surrounding woodlots in Oakville and Burlington. These wooded areas have a high component of red and white oak. Infested woodlots were severely defoliated and almost all susceptible tree hosts were completely denuded of foliage. High defoliation also occurred in the wooded area of Mountainside Park in Burlington, where red oak was the main host.

Numerous other areas within this general area of infestation had significant numbers of gypsy moth larvae but defoliation was at low-to-moderate levels. Such areas occurred around the Royal Botanical Gardens, Burlington and at Milton in Halton Region. At several of these locations large numbers of larvae appeared to be affected by the fungus, *Entomapaga maimaiga* or the nuclear polyhedral virus.

In the west part of Toronto, gypsy moth defoliated oaks and other hardwoods in a residential neighborhood in the Princess area of Etobicoke. Further north near Humberlea, high numbers of larvae severely defoliated white oaks. Other host species suffered light to moderate damage. There was an extremely high population in some parts of York Mills. A variety of hosts were affected but the most exceptional was an area of Norway maples that suffered complete defoliation. Large oaks were also affected in a residential area south of the Rosedale Golf Club and in the east part of Mount Pleasant Cemetery.

In 2006, the City of Mississauga conducted an aerial spray program on 500 ha of forested land to protect the health of oak trees from this pest (Figure 3.10). Defoliation in 2006 was noted to be at the moderate level at some locations, usually single or small groups of trees, along the Credit River in Mississauga. These areas were outside

Table 3.2 Gross area of moderate-to-severe defoliation caused by the gypsy moth in Ontario from 2002 to 2006.

Region / District	Area of defoliation (ha) 2002	2003	2004	2005	2006
Southern					
Aurora	0	0	0	69	445
Aylmer	0	0	16	32	776
Bancroft	799	5 216	248	0	0
Guelph	0	0	0	1 141	8 956
Kemptville	364	938	0	0	0
Midhurst	3 539	11 728	0	0	0
Parry Sound	7 666	25 732	0	0	0
Pembroke	2 098	0	0	0	0
Peterborough	2 330	14 690	0	0	0
Sub total	16 796	58 304	264	1 242	10 177
Northeast Region					
North Bay	0	0	177	0	132
Sault Ste. Marie	0	130	0	0	0
Sudbury	136 878	979	0	0	0
Sub total	136 878	1 109	177	0	132
Total	153 674	59 413	441	1 242	10 309

the control program areas. There was also a private aerial spray program conducted on grounds of the St. George's Golf and Country Club and on adjoining residential properties in Etobicoke. Results were excellent in terms of population reduction and foliage protection in both control projects.

In all aforementioned areas, numbers of adult moths and fresh egg masses were extremely high during the flight period. Gypsy moth populations fluctuate annually and populations are often kept in check by the larval fungus *Entomophaga maimaiga*. High humidity and temperature assist the spread and development of the fungus. It is

Figure 3.10 Mississauga gypsy moth spray program, 2006 (photo courtesy City of Mississauga).

thought that due to drier conditions in the summer of 2005, the fungus was not as prominent. Such conditions may have lead to a high survival rate of the gypsy moth, allowing for greater landscape level defoliation experienced in 2006.

Egg mass numbers are high in several of the areas mentioned signifying a similar forecast of defoliation in 2007.

Striped sumac leafroller, *Nephopterix subfuscella* (Rag.)

High populations recurred on host trees, staghorn sumac, *Rhus typhina* L. in the western portion of Norfolk County, Aylmer District in 2006. Severe defoliation resulting in tree mortality has occurred in repeatedly infested areas.

European fruit lecanium, *Parthenolecanium corni* (Bouché)

Widespread damage was recorded on many species of deciduous hosts, particularly sugar maple, across the eastern portion of the Southern Region in 2006. High scale populations can affect tree vigor and some branch tip mortality is expected if populations persist in the area (Figure 3.11). Following scale attack, sooty mold coated twigs and branches on host trees across eastern Ontario.

As is common for this pest, trees attacked by the lecanium became covered in sooty mold over the twigs and branches in the affected areas.

Figure 3.11 European fruit lecanium damage (photo by E. Czerwinski).

European snout beetle, *Phyllobius oblongus* L.

The feeding damage by the snout beetle causes a ragged appearance along the leaf margin. This insect was found causing low levels of damage to sugar maple host in Oxford and Elgin counties, Aylmer District.

Pale green weevil, *Polydrusus impressifrons* (Gyll.)

This green leaf weevil is not native to Canada, having arrived from Europe into New York State in the early 1900's. It is a pest of shade and fruit trees, as well as a number of plants, but prefers birch, willow, poplar, apple and pear trees. During the larval stage, the small larva will feed on the roots of the host tree. The pale green weevil overwinters as a larva in the ground and pupates in late April and early May.

The tiny adults, (less than 7mm) can be found feeding on the edges of leaves of many broadleaf species, particularly aspen and birch, leaving behind partially eaten leaves with many jagged margins. Feeding takes place between late May and mid-July, and usually has very little effect on tree health. They mate on the leaves and begin to lay their eggs in clusters of 20-25 eggs in cracks or crevices in the bark of the host trees. The eggs are laid as high as 3 metres on the tree and are sometimes laid on twigs or wood on the ground. The eggs will hatch between 12 and 13 days and the larvae will fall to the ground, enter the soil and feed on the roots. Once the cool weather sets in, the larvae will become dormant until the following spring.

A large number of calls and inquiries came in about this pest as it was found in high numbers right from Thunder Bay to Fort Frances. The drought in 2005 and the hot, dry spring in 2006 may have caused the population of this weevil to explode. It was seen primarily attacking white birch in the Northwest Region, giving birch leaves a ragged appearance.

Birch leaf edgeminer, *Scolineura betuleti* Klug

For the third consecutive year, moderate-to-severe browning occurred on European white birch (*Betula pendula* Roth) trees at one location in the city of Peterborough, Peterborough District.

European woodwasp, *Sirex noctilio* Fabricus

This European woodwasp is considered a secondary pest of trees in its indigenous range. It prefers hard pines (i.e. 2 or 3 needle pines) but literature suggests it may use spruce, fir, larch, or Douglas fir. However, these alternate hosts have not been documented attacked in North America. *Sirex noctilio* has a symbiotic relationship with a fungus, *Amylostereum areolatum* that the female wasp injects into trees together with a phytotoxic mucus to weaken the tree, making it suitable for the developing wasp larvae. The biology of *S. noctilio* is complex. *S. noctilio* larvae overwinter and emerge as adult wasps between the months of July and September.

This woodwasp is indigenous to Europe, Asia, and northern Africa and has successfully established populations in South Africa, South America, Australia and New Zealand. It is attracted to trees under-going stress, often suppressed trees in a stand, and particularly unmanaged, over-stocked pine stands. In the southern hemisphere, where pine is cultivated in plantations, *S. noctilio* is known to cause significant tree mortality and is therefore considered a major pest in several jurisdictions.

Sirex noctilio was first trapped in North America in 2004, when a single adult female was caught near Fulton, New York. Follow-up surveys in 2005 confirmed an established population centred around Oswego, northwest of Fulton. An Ontario survey was then initiated in 2005 by MNR and CFS, which caught females in traps near Prescott and at Sandbanks Provincial Park, Prince Edward County. A check of CFIA traps from 2005 later

confirmed the insect was also present near Uxbridge (Durham County, Aurora District) and Cambridge (Waterloo County, Guelph District)

In March, 2006 a *S. noctilio* larva was retrieved from a Scots pine, *Pinus sylvestris* tree in Cambridge. This confirmed that *S. noctilio* had established a reproducing population. To better understand this insect's actual distribution and density in Ontario, a widespread trapping program was initiated in summer 2006 in southern and parts of northern Ontario.

A total of 158 trap sites were established in 2006. Two distinct trapping projects began this year; one in the Southern Region and one in the Northeast Region. Two traps were deployed at each site in both surveys.

In the southern Ontario survey, one trap was a 12-unit Lindgren funnel trap (Figure 3.12) and one trap a APT Intercept Panel trap (Figure 3.13). Each was baited with the same ultra high release lure containing 70% alpha-pinene (75% of the + isomer and 25% of the - isomer) and 30% beta-pinene (95% of the -isomer). The 2006 detection survey for *S. noctilio* in southern Ontario focused on high risk pine stands that were preferably Scots pine, unmanaged, over stocked, with low or mild levels of stress (tree decline and mortality). The survey covered most of southern Ontario counties and regional municipalities. At least two traps sites were deployed in each county, with those counties having more pine sites receiving proportionally more trap sites (Figure 3.14).

Figure 3.12 Lindgren funnel trap used for European woodwasp.

Figure 3.13 APT intercept panel trap used for European woodwasp.

In the northern Ontario survey, both traps were 12-unit Lindgren funnel traps, one trap baited with either a ½ or full ultra high release lure containing 70% alpha-pinene and 30% beta-pinene. The detection survey for Northern Ontario started in late August following suspect specimens caught in the Sault Ste. Marie, Iron Bridge and Blind River areas and focused on the jack pine resource of the boreal forest (Figure 3.15).

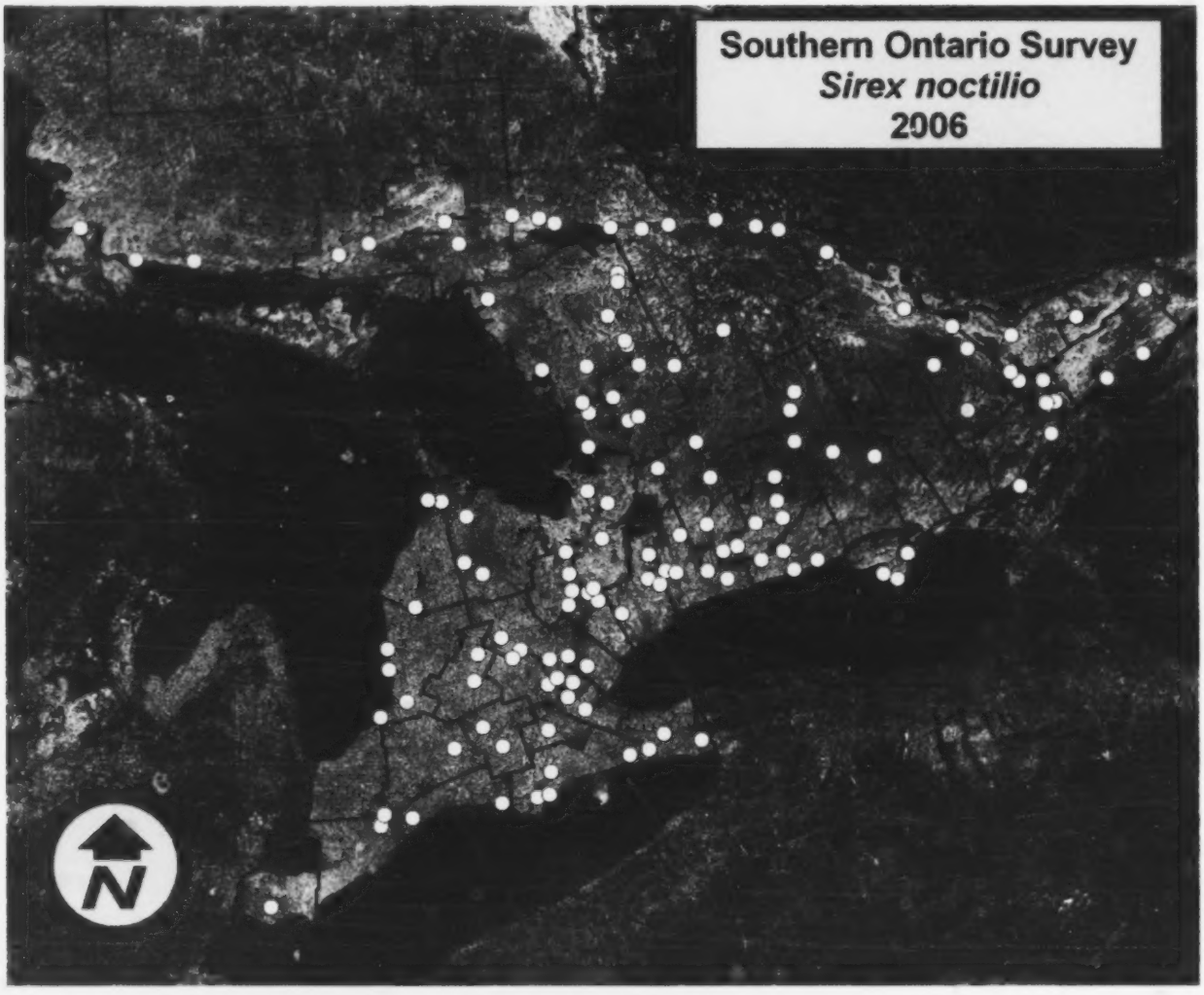


Figure 3.14 Trap sites for European woodwasp, 2006.

The trap sites in southern Ontario were dominated by Scots pine, followed by red pine, then eastern white pine hosts. In northern Ontario the focus and primary host was jack pine.

Trap deployment occurred between 26 June and 13 October 2006. Traps were placed approximately 30 metres apart and where possible 30 metres from the forest or road edge.

A total of 563 specimens representing 10 species of Siricids were collected during this survey (Table 3.3). Sirex noctilio was collected at 38 locations (Figure 3.16). Thirty seven locations had trap captures that were positive, while one location, Sandbanks Provincial Park, was also considered positive as an adult *S. noctilio* was caught by hand, not in the survey traps. A total of 74 specimens of *S. noctilio* were captured at the 37 sites in 21 counties.

In 2005, *S.noctilio* was trapped in 4 counties: Wellington, Durham, Prince Edward and Leeds & Grenville. 2006 found the insect in 21 counties: Bruce, Dufferin, Durham, Elgin,

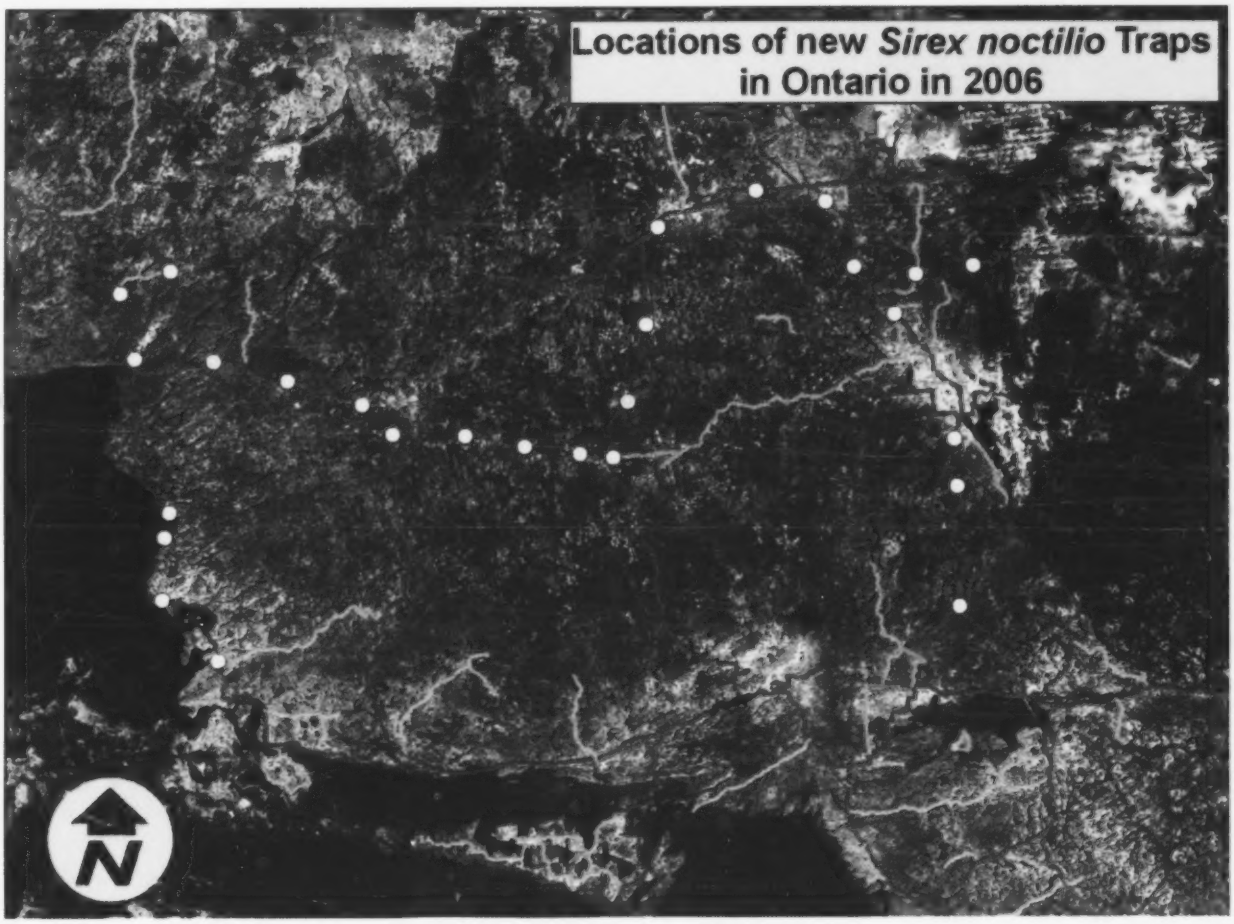


Figure 3.15 Northern Ontario trap sites for European woodwasp, 2006.

Table 3.3 Summary of total number of Siricids collected by species, number of sites represented, and date of first and last captures in Ontario in 2006.

Insect Name	Total Number of Specimens	Number of Sites (n=158)	Date first capture	Date Last capture
Sirex nigricornis	264	75	22 August	13 October
Urocerus cressoni	132	61	12 July	2 October
Sirex noctilio	74	37	12 July	10 October
Sirex edwardsii	28	18	5 Sept.	13 October
Sirex j.juvencus	26	19	31 July	4 October
Tremex columba	17	16	19 July	11 October
Sirex behrensii	12	11	20 Sept.	12 October
Urocerus albicornis	5	5	21 July	9 August
Xeris spectrum	4	4	7 July	9 August
Urocerus taxodii	1	1	4 August	-

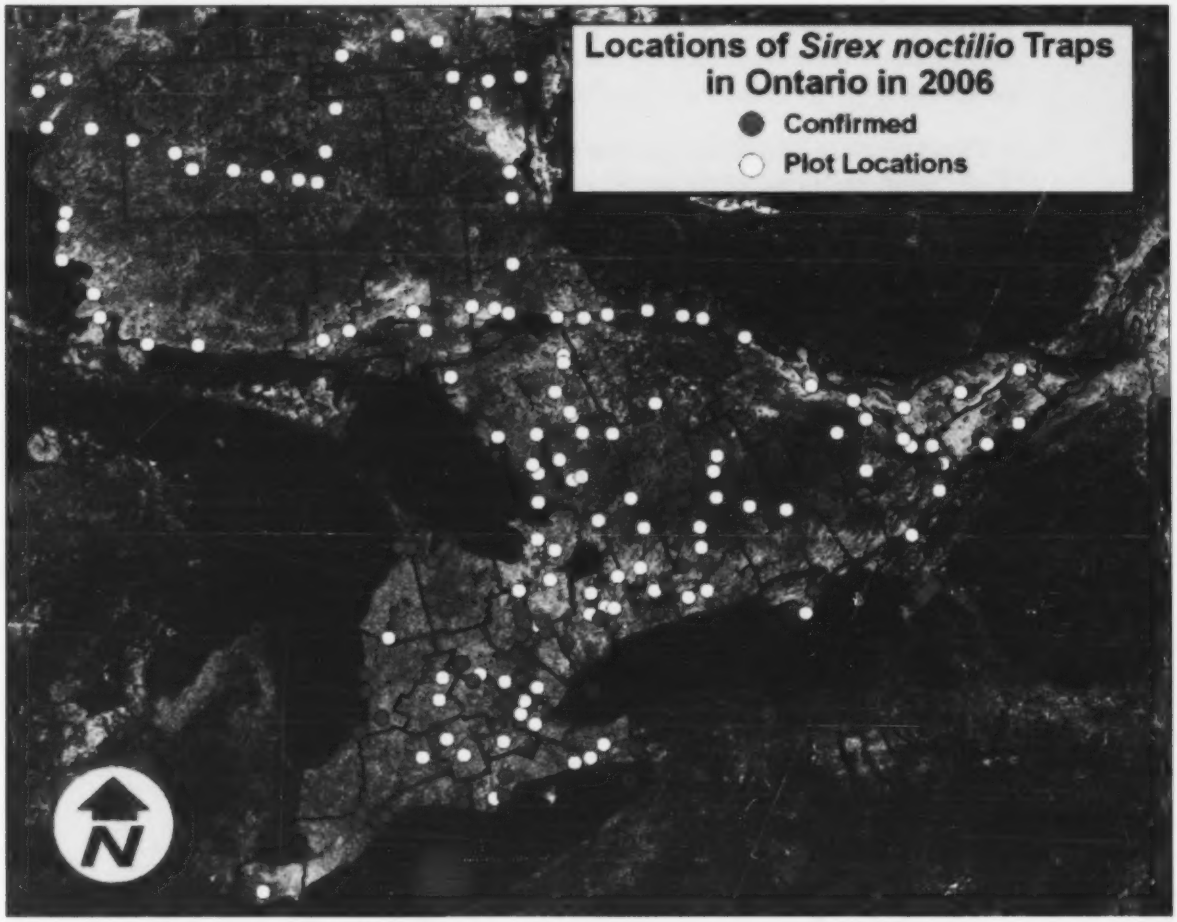


Figure 3.16 Positive sites for Sirex noctilio, 2006.

Grey, Norfolk, Halton R.M., Huron, Kent, Lambton, Leeds & Grenville, Middlesex, Niagara, Northumberland, Peel R.M., Peterborough, Prince Edward, Simcoe, Waterloo, Wellington and York R.M.

In New Zealand and Australia, S. noctilio is managed using silviculture (stand thinning) and a parasitic nematode, *Deladenus siricidicola*. The presence of this species of nematode here in Ontario is currently unknown. Surveys are underway to determine its presence in Ontario.

Pine shoot beetle, *Tomicus piniperda* (L.)

Shoot damage caused by the pine shoot beetle varied considerably as this invasive insect is ubiquitous in pine stands across most of the Southern Region. Severe shoot damage (50-90%) was observed in Scots pine stands from Wardsville, Aylmer District; east and north to Birds Creek, Bancroft Township, Bancroft District. Light shoot damage (10-35%) occurred as far north as the Trout Creek area, Laurier Township, Parry Sound District. Low levels of shoot damage recurred around Bracebridge, Parry Sound District where a containment project has been ongoing since 2001. The Ontario Ministry of

Natural Resources, as part of its Forest Health Monitoring program, has continued to maintain a pine shoot beetle trapping and population monitoring project from Bracebridge to Sault Ste. Marie along the transportation arteries of Hwy 11 and 17.

In 2006, however, a total of 143 sites had Lindgren funnel traps placed by either the CFIA or OMNR staff to detect the presence and monitor populations of the pine shoot beetle. 89 locations were selected from Sault Ste. Marie north and west at various sites to Thunder Bay for the second consecutive year. All these traps had negative results for pine shoot beetle. For the sixth consecutive year, 54 locations from Sault Ste. Marie to North Bay, south to Parry Sound and Bracebridge were surveyed using Lindgren traps baited with alpha-beta pinene.

In 2006, pine shoot beetle adults were collected and confirmed north of the initial control site in Bracebridge. Adult beetles were found at points within the administrative districts of North Bay, Sudbury and Sault Ste. Marie; however damage as a result of the feeding by the subsequent generation of pine shoot beetle was negligible in these areas.

In addition, in 2006 three-to-five trap logs one-metre in length were deployed in piles at 32 locations where captures of adult beetles in traps or logs were made in 2005. These logs were collected and pine bark removed to look for the presence of pine shoot beetle. These locations included a small stand of Scots pine west of the Town of Iron Bridge but most were concentrated around original finds near Bracebridge. Visual surveys following the log trapping effort found little to no crown or shoot damage at sites where beetles had been captured in the trap logs (Figure 3.17).

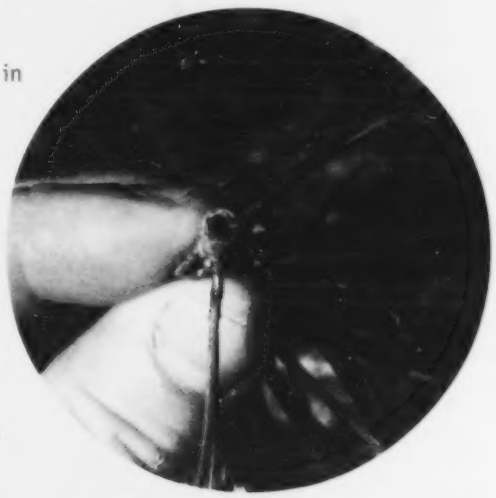


Figure 3.17 Scots pine shoot hollowed by pine shoot beetle (photo by D. Rowlinson).

FOREST DISEASES

Scleroderris canker, European race, *Gremmeniella abietina* (Lagerb.) M. Morelet

The European race of Scleroderris canker was first discovered in 1985 at two locations in Parry Sound District and one location in Bancroft District in the Southern Region.

A comprehensive survey for this disease was conducted in 1995. By this time, the disease had spread to 39 pine plantations in 12 townships in the central portion of Parry Sound District, and in single plantations in Mayo, Minden and Somerville townships, Bancroft District.

No significant surveys have occurred since to document the impact of the disease in the Southern Region. In 2006, symptoms of the disease were prevalent on red and Scots pine in some of the infection sites in McMurrich Township, Parry Sound District.

In June 2006, a new positive site with the European race was found in a red pine plantation in Laurier Township northeast of the town of South River, Parry Sound District. Infected branches were recorded on 1.5 m high trees growing on an old log-landing site.

Dutch elm disease, *Ophiostoma novo-ulmi* Brasier

Dutch elm disease continues to be a scourge of juvenile elm trees and the occasional mature elm tree that have survived earlier onslaughts of the disease outbreak in the 20th century (Figure 3.18). Usually, symptoms of the disease become evident immediately following the first heat wave of the summer. The impact of the disease was observed wide-spread throughout the Southern Region in 2006.

Figure 3.18 Dutch elm disease damage (photo by E. Czerwinski).

A more virulent form of the *Ophiostoma* fungus has been encountered throughout the region where it is not unusual for attacked trees to succumb to the disease in less than single season.

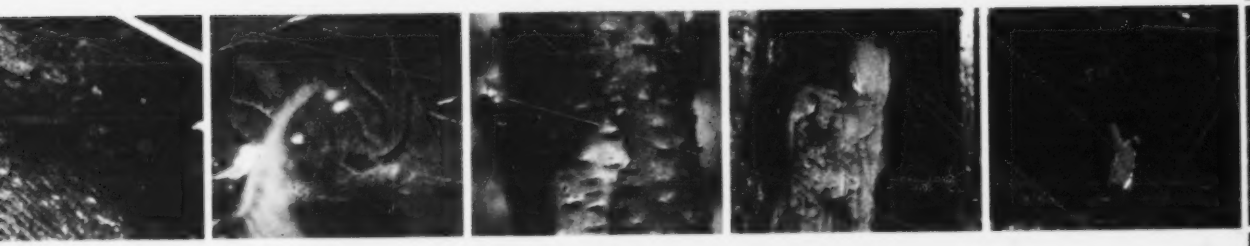
White elm (*Ulmus americana* L.) continue to die across the Southern Region from this destructive organism. The rate of spread and the time it takes to kill the host trees has risen dramatically in the past few years. Widespread mortality even to younger trees has been devastating along fence rows, field edges, and abandoned fields, urban and ornamental trees. In most dead trees examined, the only beetle found has been the European elm bark beetle (*Scolytus multistriatus* (Marsh.)).

Northwest Region

M. Francis[1], L. Rowlinson[1] and B. Smith[2]

[1] Ontario Ministry of Natural Resources, Forest Management Branch, Forest Health & Silviculture Section
[2] Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie

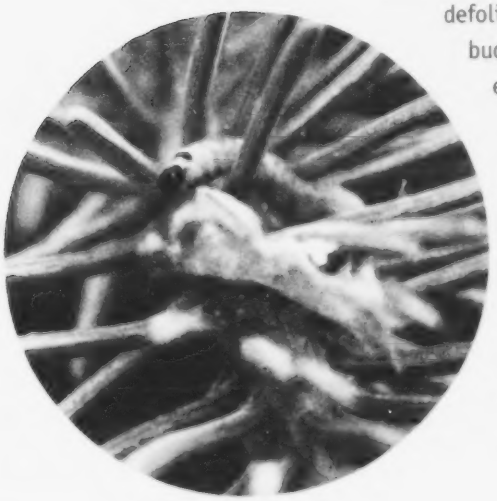
SECTION 4



FOREST INSECTS

Eastern blackheaded budworm, *Acleris variana* (Fern.)

This defoliator was found at low levels across the Thunder Bay and Nipigon districts causing trace defoliation on black and white spruce in 2005. This defoliation was originally thought to be caused by eastern spruce budworm, but when the bud cap was removed the larvae of the eastern blackheaded budworm was the only defoliator present.



The previous two years had seen an increase in this defoliator, but in 2006 the population decreased substantially with trace levels on predominantly black spruce. This has been the historical trend in Ontario, where the population increases, causes light defoliation and then collapses.

Figure 4.1 Blackheaded budworm larvae (photo by M. Francis).

Bronze birch borer, *Agrilus anxius* Gory

In the Northwest Region the bronze birch borer has been causing white birch (*Betula papyrifera* Marsh.) mortality in Thunder Bay and Nipigon districts for the past several years. Semi-mature white birch mortality along Highway 11/17 between Nipigon and Thunder Bay, and just west of Thunder Bay, was quite common in 2006. In the City of Thunder Bay white birch boulevard trees of all ages have been under attack by this pest for the past three years.

Figure 4.2 Exit hole of adult bronze birch borer on white birch (photo by M. Francis).

Many of the over-mature white birch trees have been removed since they have become a hazard along roadways. Collections from white birch, aspen and balsam poplar trees were made in June by the Canadian Forest Service and the Ministry of Natural Resources staff as part of a research study on *Agrilus* species. The research is investigating the presence of parasites and predators of native *Agrilus* species to compare signs, symptoms and tree response with the emerald ash borer (*Agrilus plannipennis* Fairmaire) an invasive species. Due to the close taxonomic relationship between these two species, this research may help in understanding this invasive pest and could aid in the ongoing battle in southwest Ontario and several US states.

Bronze poplar borer, *Agrilus liragus* B. &B.

In 2004 and 2005 this borer caused balsam poplar mortality in and around the City of Thunder Bay. Bronze poplar borer was observed attacking balsam poplar (*Populus balsamifera* L.) and aspen trees in Nipigon District in 2006.

A small area (126 ha) of mortality was aerially mapped on the southwest side of Ledger Township north of Nipigon (Figure 4.4).

Attacks by this wood borer were on overmature aspen trees. There were no signs of D-shaped exit holes on these trees, but upon further inspection, trees with thinning crowns had larvae burrowing beneath the bark. This pest has contributed to aspen and balsam poplar mortality along the Highway 11/17 corridor between Thunder Bay and Nipigon. Mortality has not been observed in the remainder of the region.

Figure 4.3 Galleries created by bronze poplar borer larval feeding (photo by M. Francis).

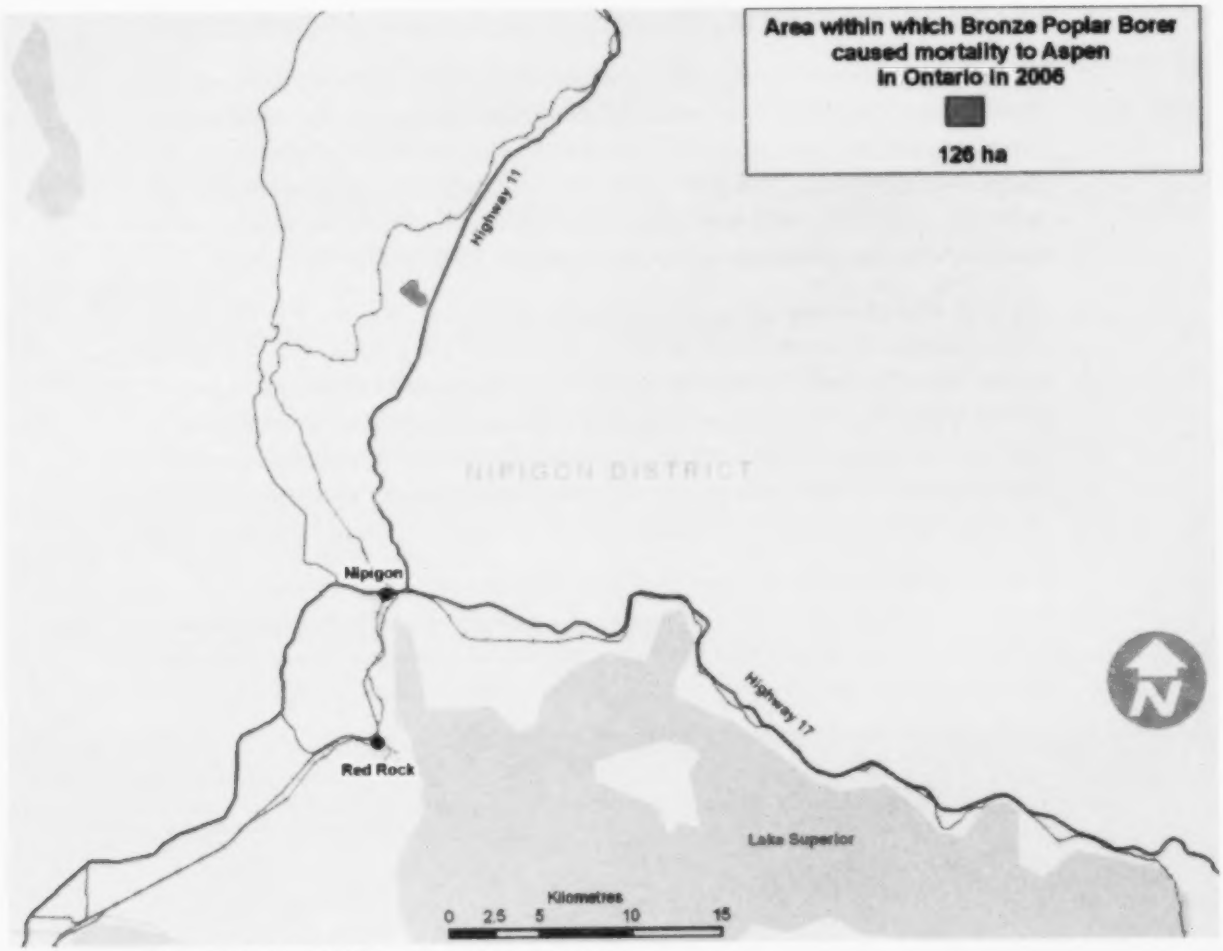


Figure 4.4 Area of bronze poplar borer damage.

Collections were also made of trees infested with bronze poplar borer as part of the Agrilus research project described above.

Willow leaf beetle, *Calligrapha multipunctata bigsbyana* (Kby.)

In the Northwest Region in 2006, defoliation by this willow defoliator was found in the western edge of Fort Frances District. The willow leaf beetle feeds primarily on willow (*Salix* sp.) but can also be found on aspen (*Populus* sp.). The larvae initially skeletonize the leaves but will eventually eat the whole leaf except the main vein. Adult beetles also feed on the foliage until the first frost and then remain dormant until the following spring. In 2006, the larvae were feeding on shrub willows in several cutovers. Defoliation ranged from 20% to 50% in the Hay Bay area east of the village of Morson.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.)

This leaf tier is considered to be one of the most serious pests of trembling aspen (*Populus tremuloides* Michx.) in Canada sometimes equalling the damage caused by forest tent caterpillar. Damage occurs on aspen and poplar, as well as white birch, willow, cherry (*Prunus* sp.) and alder (*Alnus* sp.). In Ontario there have been four major outbreaks: 1912, 1943, 1955 and 1968. In the Northwest Region 24,757 ha of moderate-to-severe defoliation was aerially mapped in 2006 (Figure 4.5).

Scattered areas of moderate-to-severe defoliation by this pest were found in the northern portion of Kenora district as well as the western and northern area of Red Lake District. The majority of the defoliation (23,681 ha) was observed in the Kenora District. Moderate sized pockets of defoliation were mapped southwest of Umfreville Lake near the Ontario/Manitoba border as far south as Minitaki. A larger area was also observed on the northeast side of Umfreville Lake. The eastern extent of the defoliation was along the southern shore of Maynard Lake.

In Red Lake District there were two small areas of large aspen tortrix defoliation totalling 1,076 ha in 2006. The first was located around Artery Lake in the northwest corner of Woodland Caribou Provincial Park south west of Pikangikum. The second area was west of Poplar Hill.

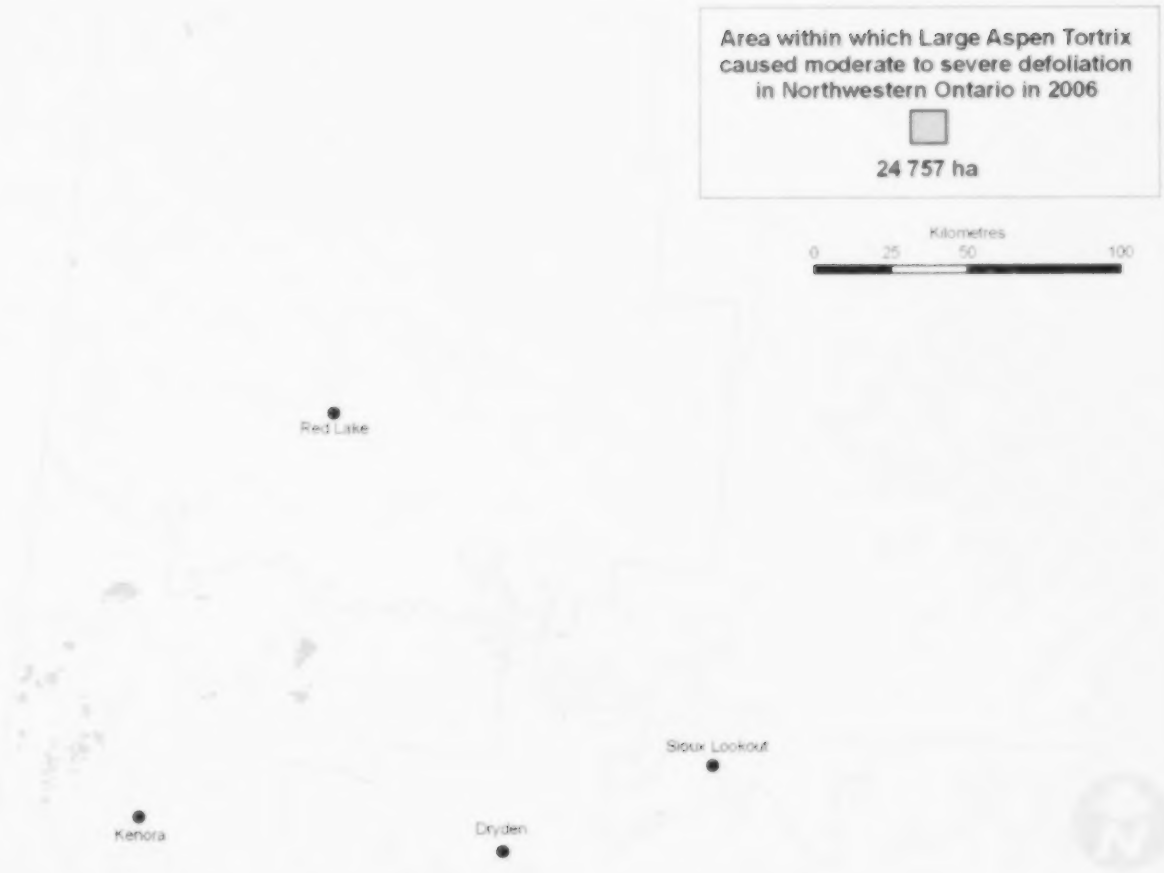


Figure 4.5 Area of large aspen tortrix defoliation in the Northwest Region.

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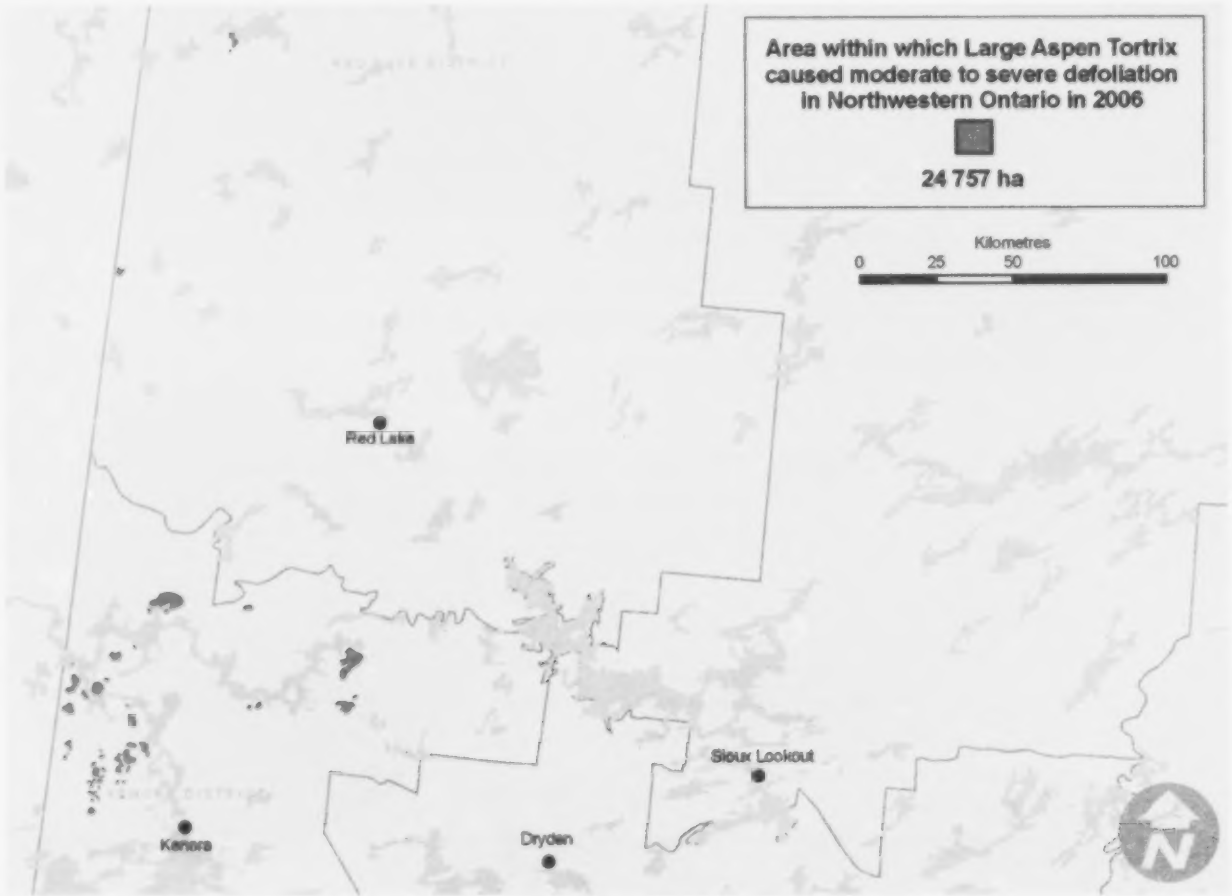

Figure 4.5 Area of large aspen tortrix defoliation in the Northwest Region.

Aspen twoleaf tier, *Enargia decolor* (Wlk.)

Two epidemics of this aspen defoliator have occurred in the Northwest Region of Ontario; one from 1959 to 1963 and the other from 1970 to 1971. In 2006, defoliation was observed in the far northern boundaries of Sioux Lookout and Thunder Bay districts. The majority of the defoliation was found north and east of Pickle Lake as far as Fort Hope.

Alder woolly sawfly, *Eriocampa ovata* (L.)

This insect was found early in the season causing moderate to severe defoliation on alder trees (*Alnus incana ssp. rugosa* (Du Roi) J Clausen) in Kenora and Fort Frances districts. This insect is often not reported on since alder are not a commercial species. As with many early season defoliators, trees have an opportunity to produce another flush of foliage, therefore, there is little negative effect on the health of the tree.

Fall webworm, *Hyphantria cunea* (Drury)

The fall webworm's web tents, which typically cover the ends of branches was a common sight throughout Ontario during late July and early August. It was observed spinning its web across the Northwest Region at various levels in 2006. Low levels of this pest were found feeding on alder, young white birch and cherry trees close to the City of Thunder Bay and along the Highway 11/17 corridor. This represented a decrease in defoliation from the last couple of years.

Populations were higher in the southern portion of Fort Frances District and were most common in and around the town of Fort Frances. Small colonies of the hairy larvae were also found along the southern end of Highway 71 in the Caliper Lake area as well as the north side of Hwy 17 at Kenora.

In the Sioux Lookout, Dryden and Red Lake districts high populations of this webworm were recorded on roadside trees. This insect hosts include more than 100 species of forest and shade trees, but ash seemed to be the preferred host.

Fall webworm is not normally a problem due to the late season nature of its feeding. Much of fall webworm damage occurs after trees have completed their growing for the season and as a result little negative impact is felt by its host trees.

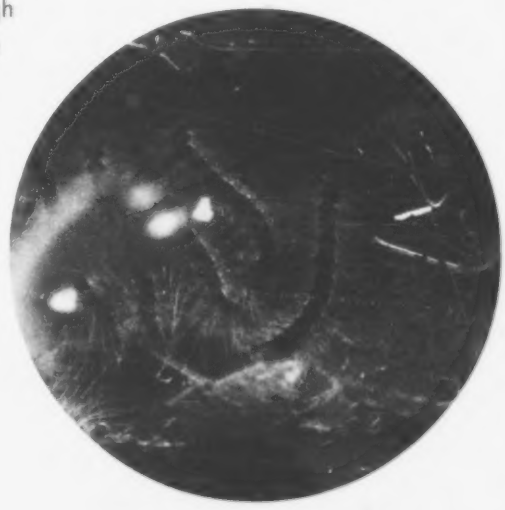

Figure 4.6 Fall webworm larvae feeding within their protective webbing (photo by M. Francis).

Willow flea weevil, *Isochnus rufipes* (LeC.)

This late summer leaf miner was found in the town of Fort Frances where individual willow trees in Pither's Point Park displayed 100% defoliation. Although not a pest of major consequence in forests, it causes great concern for landowners that have willow trees on their property. Shining willow (*Salix lucida* Muhl. ssp. *lucida*) is one of the most popular landscape willows and feeding damage by the larval stage of this pest causes premature browning of leaves in late summer. Damage normally becomes visible during mid-to-late August and by this time the season's growth is complete, therefore it usually has little effect on the overall health of the tree.

Whitespotted sawyer beetle, *Monochamus s. scutellatus* (Say)

This wood borer was causing damage in a number of areas in the Northwest Region in 2006. After a number of years of drought, fire, snow damage, blow down and logging there are areas of dead or dying trees and slash resulting in an increase of dead wood material across the region. This beetle prefers recently dead or dying trees and will lay eggs under the bark where larvae will feed for two years. Upon emerging, adult beetles will feed on tender bark of twigs on surrounding healthy trees. This feeding interrupts water and nutrient transport to and from branches causing needles to turn red.

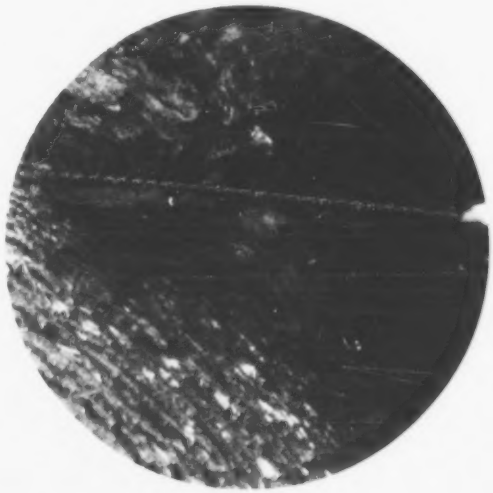

Figure 4.7 Adult whitespotted sawyer beetle (photo by M. Francis).

In the Armistice Creek area in Thunder Bay District jack pine trees along forest edges near a cutting operation were heavily damaged by adult maturation feeding. Younger trees had the most damage and many of these trees could be dead by next year. Bark on some thinner branches was totally removed by feeding beetles. During ground checks the adults were seen mating and some females were laying eggs on jack pine wood piles. Beetles were so numerous tree cutters reported having to brush the beetles off themselves each day. Similar damage was also found in the Sioux Lookout District near Goodie Lake and east of Savant Lake. Logging operations were also taking place in these areas. Outbreaks of this borer related to forest harvest operations are usually short lived and normally damage is limited to trees along forest edges.

Spiny elm caterpillar, *Nymphalis antiopa* (L.)

This insect is the larval form of the Mourningcloak butterfly. It was found throughout both the Kenora and Fort Frances districts in 2006. Severe defoliation was recorded on clumps of aspen trees. This usually occurred in singular or two trees but incidence was

widely scattered. Although large numbers of this insect can sometimes be found, foliage loss is not severe enough to pose a threat to the tree.

Woolly alder aphid, *Prociphilus tessellates* (Fitch)

A number of homeowners in the area of Fort Frances and Emo were concerned as a number of their silver maple trees had browning and curling leaves. Silver maple (*Acer saccharinum* L.) is an alternative host of the woolly alder aphid and evidence of this pest was also observed on some bur oak trees. The aphids feed in massive colonies on leaves and the waxy, wool-like covering over their bodies gives the appearance of large white puff balls. Ants will often feed on pale liquid called honeydew which is excreted by the aphids after feeding on sap from the leaves of the host tree.

Damage by these aphids is normally sporadic and high populations will last only one year followed by no signs in subsequent years.

Flat leaftier, *Psilocorsis reflexella* Clem.

This insect is commonly found on oak (*Quercus* sp.) as well as a number of other deciduous tree species throughout North America. It lives a solitary life and carries out its feeding between two leaves that it ties together.

In 2006 this insect was found near the junction of Hwy 11/71 and Turtle River Road in Fort Frances District on a small pocket of understory oak trees. The level of defoliation was between 10% and 20%.

Aspen, balsam poplar and white birch mortality

The general health of aspen, balsam poplar and white birch has been declining for the last number of years along the highway 11/17 corridor between Thunder Bay and Nipigon. Stress from defoliators, wood borers, disease and abiotic factors have led to mortality in these stands. Forest health events in these stands in the last 4 years include: forest tent caterpillar (now collapsed), birch leaf miner, aspen leaf blotch miner, pale green weevil, bronze poplar borer, poplar borer, bronze birch borer, armillaria root rot, hypoxylon canker, shoot blight of aspen, septoria leaf spot, drought, and an early flush of leaves in 2005 followed by cooler temperatures.

This mortality has occurred in close proximity to the highway corridor.

Jack pine mortality caused by borers and bark beetles

Between October 24th and 26th, 2001 there was a severe windstorm combined with large amounts of snow and freezing rain in the Northwest Region in the Thunder Bay and Nipigon districts. Beetle activity in the coming years in affected stands was anticipated following this disturbance event. In 2005, over 17,000 ha of whitespotted sawyer

beetle maturation feeding was seen in the northeast side of Thunder Bay District and the northwest side of Nipigon District. This area coincides with the worst hit areas of the snow damage in 2001. Ground checks also revealed other beetle activity from the pine engraver (*Ips pini*), striped ambrosia beetle (*Trypodendron lineatum*) and a bark beetle (*Hylurgops pinifex*) which attacks the base of pine trees.

In July 2006, 1,322 ha of jack pine mortality was mapped in these areas (Figure 4.8). The majority of the mortality was in the Collins Lake area, west of Armstrong, in several small pockets on the northeast, northwest and south sides of the lake in Thunder Bay District. Just south of the Armstrong airport was a large contiguous area with jack pine mortality. Smaller pockets of mortality were scattered in the Nipigon District east of Armstrong along the CNR tracks and the southwest side of Abamasagi Lake (north end of Hwy 643).

A 100 tree mortality plot was established in the Armstrong area in 2005. These jack pine trees were rated in 2005 for condition (tree and top), amount of maturation feeding and number of eggsites from sawyer beetles, and the presence of other insects or pathogens. These trees were rated again in August of 2006. There was no new

Figure 4.8 Jack pine mortality caused by a combination of borers and bark beetles.

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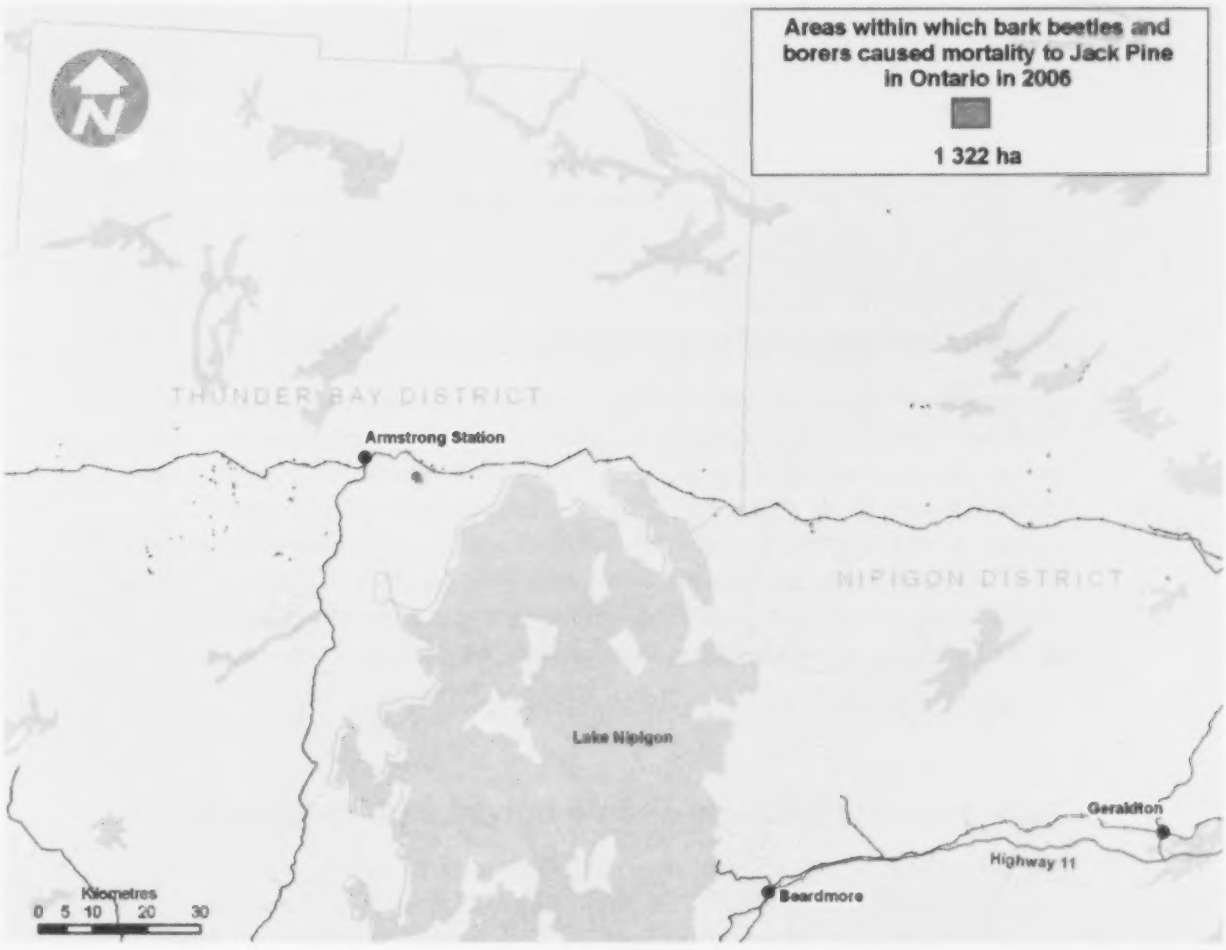

Figure 4.8 Jack pine mortality caused by a combination of borers and bark beetles.

maturation feeding at this time, but some trees had sawdust at the base of the tree indicating boring by beetle larvae inside the tree. Within the plot area, a total of 14 jack pine trees died in 2006 (Table 4.1). Of these 14 trees, 64% were in poor condition and 36% were in fair condition in 2005. All the trees that had an initial condition rating of 1 (good) in 2005 were still alive in 2006. All of the dead trees had a high number of eggsites and 71% of these dead trees had moderate or heavy maturation feeding in 2005.

If this trend continues, further mortality can be expected in 2007 to approximately nine of the remaining live trees with high numbers of eggsites. Trace levels of armillaria root rot were present on some dead trees and low levels of pine engraver (*Ips pini*) were present on a few live trees. These pests may be contributing to accelerated or additional mortality.

Table 4.1 Summary of jack pine tree condition and sawyer beetle activity for plots in the Armstrong area 2005.

Tree #	Tree		Sawyer Beetle	
	Condition	Top	Maturation Feeding	Eggsites
9	Poor	Broken	Moderate	Heavy
32	Poor	Dead	Light	Heavy
33	Fair	Live	Light	Heavy
34	Fair	Live	Moderate	Heavy
35	Poor	Live	Moderate	Heavy
36	Poor	Broken	Heavy	Heavy
37	Poor	Live	Moderate	Heavy
38	Poor	Live	Heavy	Heavy
52	Poor	Broken	Moderate	Heavy
57	Poor	Broken	Moderate	Heavy
89	Poor	Broken	Light	Heavy
91	Fair	Live	Light	Heavy
99	Fair	Live	Moderate	Heavy
100	Fair	Live	Heavy	Heavy

FOREST DISEASES

Armillaria root rot, *Armillaria spp.*

A total of 352 ha of jack pine mortality caused by armillaria root rot was aerially mapped west of Jellicoe in the southern end of Walters and Leduc townships in Nipigon District in 2006 (Figure 4.9). The bulk of the mortality was mapped between Nezah and Rolland Lake. Not all of this mortality was new, but had been occurring for the last 6-7

Figure 4.9 Area of armillaria root rot damage.

years. Six mortality plots were established in this area in 2006, a summary of these results is presented in Table 4.2. Initially, mortality plots were to consist of 100 trees in a 2.0m strip, but due to tree spacing, it was reduced to 50 trees. Plot #1 had only 25 trees as there was a change in stand composition to predominantly aspen. Five plots were established in the affected area and one plot (#6) was set up outside the area as a control.

The highest rates of mortality (70%) were recorded in the south east corner of Westman Lake, situated between Rolland and Nezah Lake. The other plots experienced between 40-50% mortality. The recently killed trees had extensive armillaria infestation, as well as some whitespotted sawyer beetle damage and in some cases pine engraver making it difficult to determine which pest was causing the mortality. Investigation of live jack pine trees at these sites with thinning or dying tops revealed armillaria attacking the tree with no sign of sawyer beetle or other bark beetles. This indicates that armillaria is likely the primary cause of mortality in these stands.

The control plot had 42% mortality, but almost half of this mortality was blowdown. It was difficult to locate alternate jack pine stands for control plots outside of the affected area that were within reasonable proximity to the mortality.

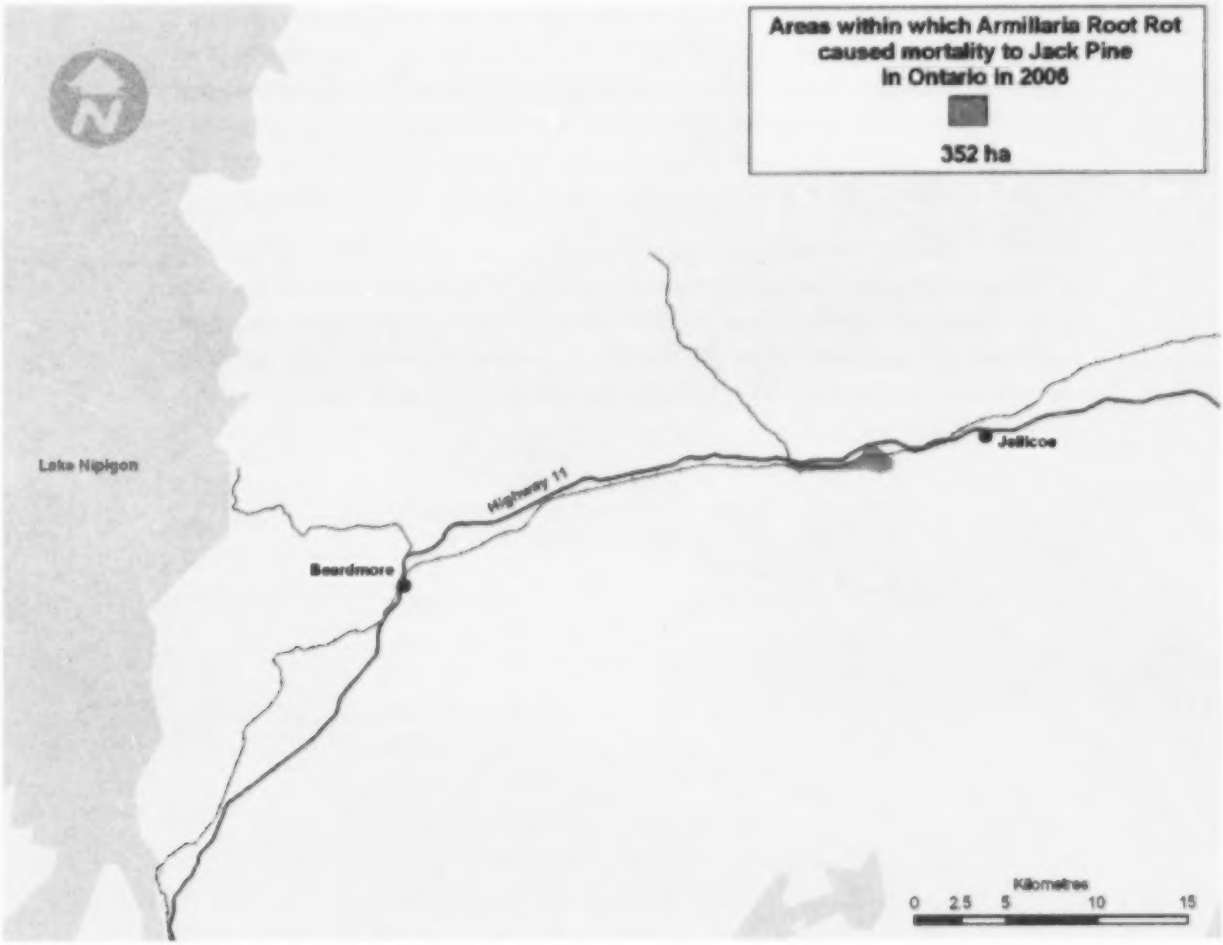

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Table 4.2 Summary of jack pine mortality caused by armillaria root rot in 2006 in Nipigon District.

Plot	Number of dead trees							Total Dead
	2006	2005	2004	2003	2002	2001	Dead more than 5 yrs	
1	0	1	1	1	1	1	11	16
2	2	0	3	1	0	0	22	28
3	7	2	4	4	4	1	6	28
4	1	0	1	2	5	2	24	35
5	1	0	1	3	3	1	12	21
6	0	8	0	5	4	1	3	21

Septoria leaf spot, *Mycosphaerella populorum* G.E. Thomp. and *Septoria betulae* Pass.

Septoria leaf spot was seen across both the Nipigon and Thunder Bay districts at varying levels in 2006. The most severely affected area was around Terrace Bay in Nipigon District. The majority of the damage occurred on white birch in this area, and aspen was also affected to a lesser degree.

Mature aspen trees around the Kopka River area in Thunder Bay District were also severely affected. The most heavily affected were single trees. Many had very little foliage left on the tree since septoria infection had resulted in early leaf drop.

FOREST ABIOTIC EVENTS

Blowdown

In 2006 there was very little blowdown in the Northwest Region relative to previous years. Two small areas of blowdown totalling 208 hectares were mapped in Thunder Bay District in 2006. Both areas were west of Kakabeka Falls. The largest pocket was near Twist Lake in Marks Township, while the smaller pocket was near the Matawin River Nature Reserve. Small areas of blowdown also occurred in Sioux Lookout District along the edges of many of the blowdown areas mapped in 2005. None of the newly damaged areas were more than a few hectares in size, with the largest areas of damage appearing near Pickle Lake. The wind event causing this damage was the tail end of the tornado which crossed the south end of Lake Winnipeg in Manitoba on August 5, 2006.

Drought

Drought damage in the Northwest Region was observed in Red Lake, Sioux Lookout and Dryden districts in 2006. Very little precipitation and hot, dry weather was common in 2006 and the trees suffered significantly. Road-side alder and larch which normally grow under more moist conditions showed the most damage. White birch on thin soils and hill tops turned yellow early in August.

Northeast Region

D.T. Rowlinson [1], W.D. Biggs [2], A.J .Keizer [2], H.D. Lawrence [2]

[1] *Ontario Ministry of Natural Resources, Forest Management Branch, Forest Health & Silviculture Section*
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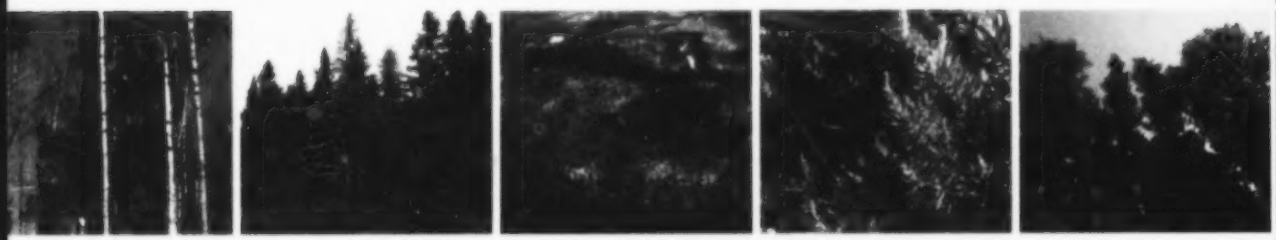

ASPEN MORTALITY AND DECLINE UPDATE (2000-2006)

Repeated annual defoliation by forest tent caterpillar (*Malacosoma disstria* Hbn.) infestations, successive years of drought-like conditions and winter thaw-freeze events, have all combined to cause, or contribute to, the death of poplar trees in six northern districts. The causal events occurred during 1999 and 2000, according to growth ring analyses. The resulting mortality, which occurred over subsequent years, was aerially mapped over 515,515 ha, through the Chapleau, Cochrane, Hearst, Kirkland Lake, Timmins and Wawa districts. Six years later, the residual effects are still lingering, with decadent and newly-dead aspen and balsam poplar trees still evident through most of the affected stands.

Many areas have since been salvaged and many areas have begun regenerating with species such as balsam fir and spruce where these are the common understory species. To a lesser degree, some stands are regenerating to hardwoods, such as aspen (*Populus* spp.) and birch, while others have only shrub growth consisting of alder (*Alnus* spp.), beaked hazelnut (*Corylus cornuta* Marsh.) and willow (*Salix* spp). As Table 5.1 indicates, mortality is continuing in affected stands but primarily from secondary organisms such as Armillaria root rot (*Armillaria* spp.), Poplar false tinder rot (*Phellinus tremulae* Bondartsev), and poplar borer (*Saperda calcarata* Say), to name a few. In response to this disturbance event and aspen decline in the region, plots were established as part of an ongoing research and monitoring project called Climate Change Impacts on the Productivity and Health of Aspen (CIPHA). More information on CIPHA is available at the website: http://nofc.cfs.nrcan.gc.ca/cipha/index.html

Table 5.1 Results of six stands monitored as part of the climate change project, CIPHA (Climate Change Impacts on the Productivity and Health of Aspen).

Location	Year	Total Trees	# Alive	# Dead	% Mort.	#New Dead	% New Dead [1]
Machin Twp	2001	93	57	36	39	na	na
(Hearst district)	2002	93	38	55	59	19	33
	2003	93	32	61	66	6	16
	2004	93	28	65	70	4	13
	2005	93	27	66	71	2	4
	2006	93	22	71	76	5	18
Fournier Twp	2001	85	44	41	48	na	na
(Cochrane district)	2002	85	41	44	52	3	7
	2003	85	36	49	58	5	12
	2004	85	31	54	64	6	14
	2005	85	27	58	68	4	13
	2006	85	23	62	73	4	15
Alexandra Twp	2001	93	47	46	49	na	na
(Cochrane district)	2002	93	43	50	54	5	9
	2003	93	40	53	57	3	7
	2004	93	39	54	58	1	3
	2005	93	37	56	60	2	5
	2006	93	33	60	65	5	11

[1] % New dead = 100 X # died since last assessment / # alive last assessment

FOREST INSECTS

Bronze birch borer, *Agrilus anxius* Gory

The bronze birch borer is well established in many white birch stands in the Sudbury Basin. Dead and declining white birch are very common in the greater Sudbury area. Many of the stands are growing on very poor sites, resulting in trees under a great deal of stress. Insect attack usually starts at the top of the tree's main stem and works its way down until the tree is eventually killed. The larval stage causes damage by making tunnels under the bark, resulting in symptomatic raised areas or linear bumps visible on the stem.

Maple petiole borer, *Caulocampus acericaulis* (MacG.)

The maple petiole borer has been present in the region for several years and once again occurred in 2006. Heavy leaf drop was apparent throughout the north portion of the city of Sault Ste. Marie and north to the Pancake Bay area.

Aspen two-leaf tier, *Enargia decolour* (Wlk.)

The major infestation which was evident from Shining Tree to Matachewan in the district of Timmins in 2005 was reduced to small pockets of severe defoliation in 2006

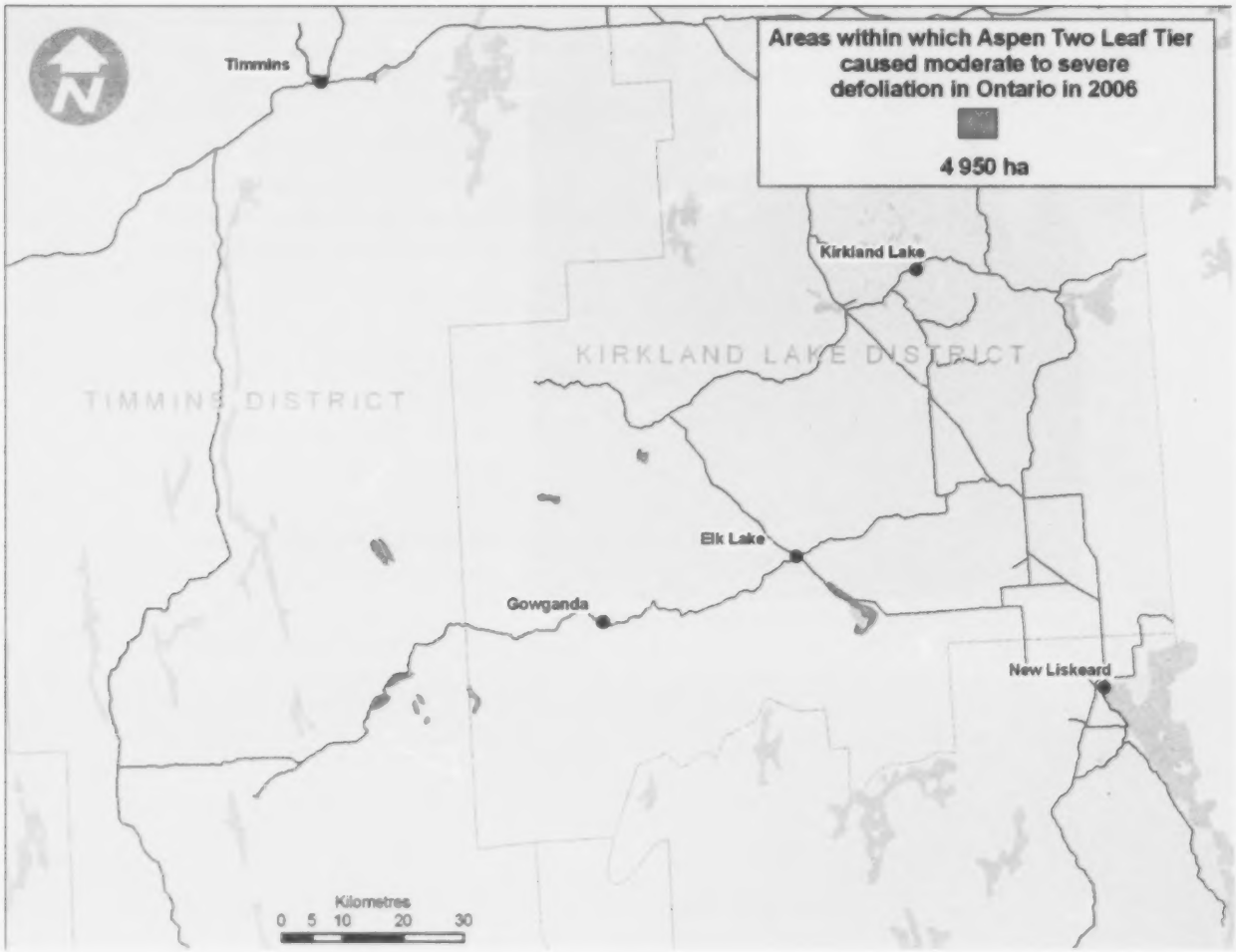

Figure 5.1 Area of aspen two-leaf tier defoliation.

(Figure 5.1). The total area affected was 4950 ha along Highway 560, north of Gowganda, and south of Elk Lake.

Fall webworm, *Hyphantria cunea* (Drury)

High numbers of webs and associated larvae were visible along Highway 17 on the north shore of Lake Nipissing from North Bay to Sturgeon Falls. In some instances mature trees were totally covered in webbing and 100% defoliated. Damage to a lesser extent was also reported in the Sudbury area.

Northern spruce engraver, *Ips perturbatus* (Eich.)

There are many species of engraver beetle. These insects aid in the break down of trees that are extremely stressed as a result of other factors such as drought, over-maturity, or poor growing conditions. Under ideal conditions these bark beetles can attack healthy host trees and cause extensive mortality. In 2005 in Wawa district, large over-

Figure 5.2

mature white spruce began to show symptoms of stress. Further decline was observed in 2006 (Figure 5.2).

Large over-mature white spruce mortality was noted in and around the town of Wawa extending south into Lake Superior Provincial Park and northwest along the Lake Superior shoreline. Dying trees had several other features, making them an attractive target for the northern spruce engraver beetle. In 2006, damage expanded with a total of 4,410 hectares of white spruce mortality mapped (Figure 5.3).

Figure 5.3

Figure 5.2 White spruce mortality from spruce engraver (photo by D. Rowlinson).

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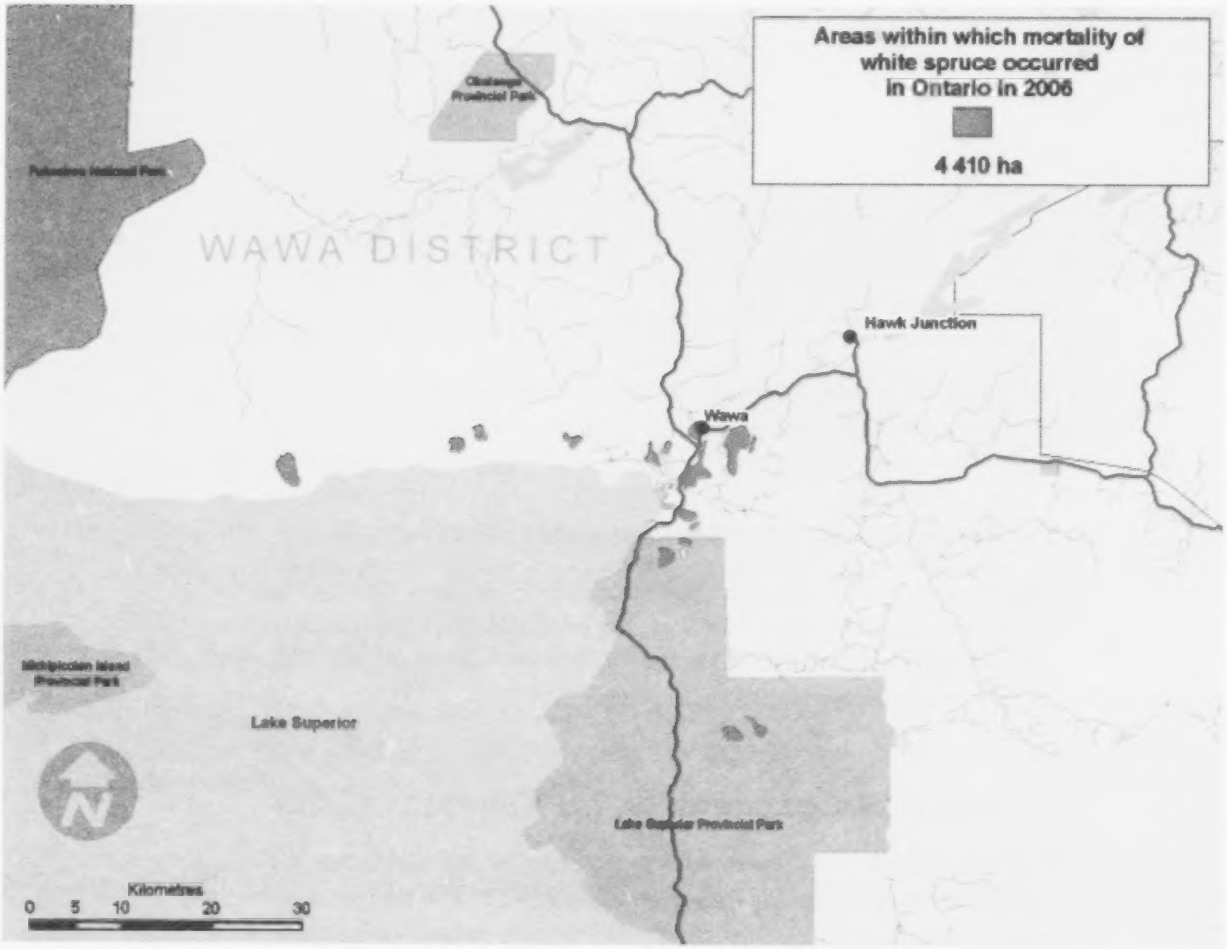

Figure 5.3 White spruce mortality in the Northeast Region, 2006.

Willow flea weevil, *Isochnus rufipes* (LeC.)

Population levels of willow flea weevil have been building for the past couple of seasons in the Sudbury district. This insect feeds between the willow leaf layers and causes brown blotches to appear on the upper side of the leaf.

Yellowheaded spruce sawfly, *Pikonema alaskensis* (Roh.)

Severely defoliated white spruce regeneration was visible in 2006 along most major highways across the northeast region. Varying levels of defoliation were observed on ornamental blue and white spruce in the community of Sudbury.

FOREST ABIOTIC EVENTS

Wind and storm damage

On July 17th 2006, a major storm front moved through the Northeast Region of Ontario. Damaging winds were reported from 120 to 150 km/hr. The majority of the damage in the eastern parts of the region occurred primarily in the North Bay District over approximately 25,721 hectares of mixed-wood forests. The largest area of damage occurred in the Temiskaming area near the Temiskaming River, south of the Samuel de Champlain Park and in the vicinity of Tomiko Lake. A small area of blowdown, approximately 1,904 ha, occurred southwest of Larder Lake in McElroy Township.

Figure 5.4 Blowdown in the Northeast Region, 2006 (photo by D. Rowlinson).

Area within which Blowdown
damage occurred
in Northeastern Ontario in 2006
38 939 ha

High, damaging winds also caused extensive damage throughout an area straddling the northern portion of Chapleau District and into southern Hearst District, totalling 11,255 ha for these two districts. The townships within this area include: Coderre, Buchan and Davin with the majority of damage falling in Steffansson and Amundsen Townships laying north of Dunrankin station along the Canadian National Railway. All species were affected during the wind event. Damage ranged from snapped stems on aspen to complete blowdown of stands of spruce and jack pine. Figure 5.5 depicts the area within which the 38,939 ha of blowdown damage occurred in the Northeast Region in 2006. 57,135 ha of blowdown and wind damage occurred in Ontario in 2006.

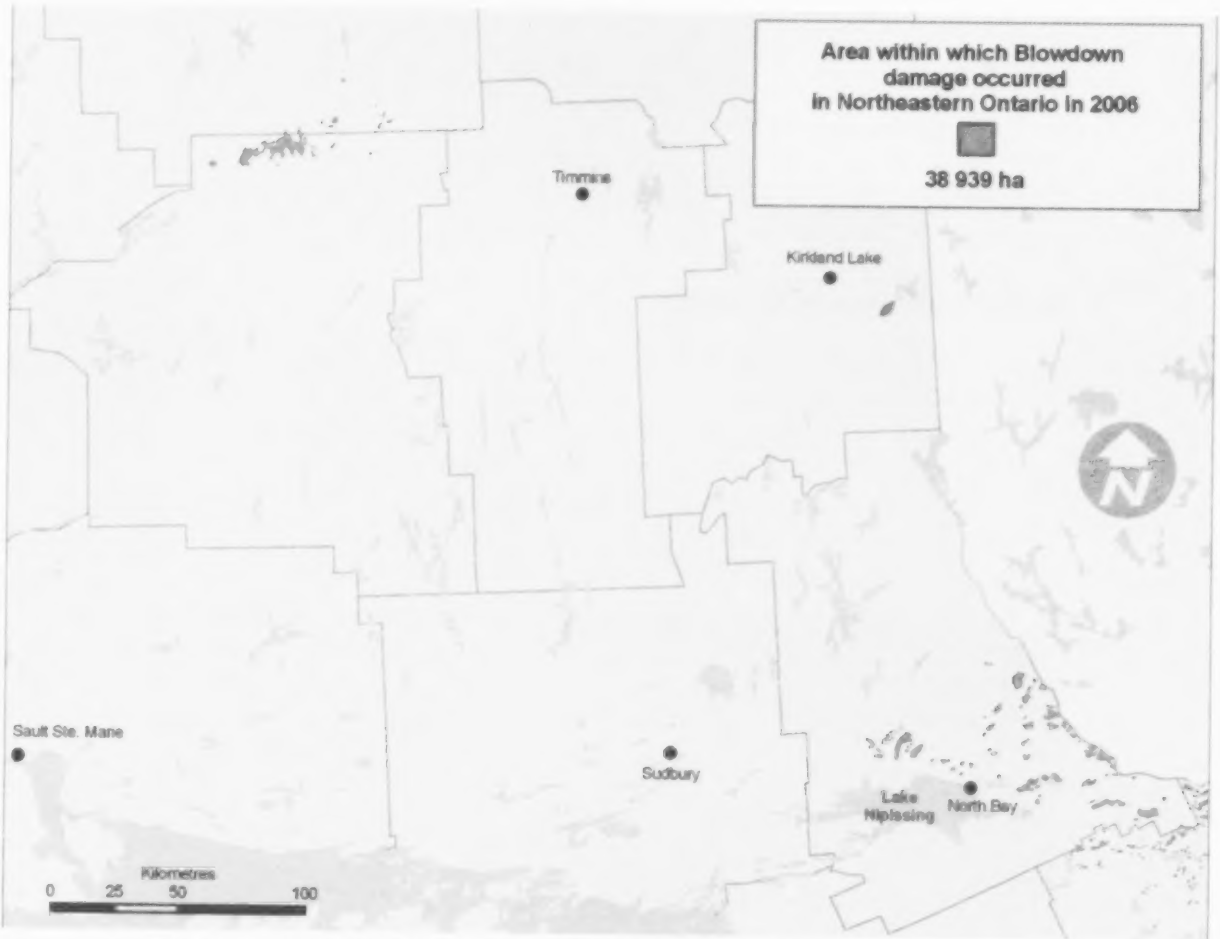

Figure 5.5 Area within which blowdown occurred in the Northeast Region, 2006.

Southern Region

E. J. Czerwinski[1], L. Tucker[1], H.J. Evans[2], W.D. Biggs[2], and W.I. Ingram[1]

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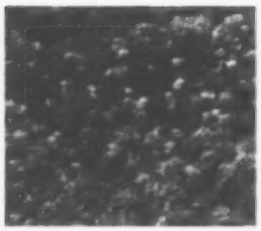
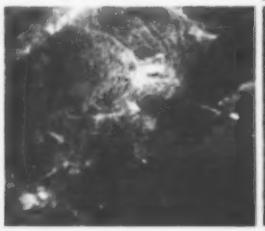
SECTION 6





FOREST INSECTS

Bronze birch borer, *Agrilus anxius* Gory

Heavy damage was once again recorded in the Kemptville District in 2006. Extensive mortality continued east of Ottawa into the Hawksbury area on both mature and juvenile white birch (*Betula papyrifera* Marsh.) trees. Numerous extension calls were received from the towns of Smith Falls and Carleton Place regarding ornamental birch trees with top mortality.

Two-lined chestnut borer, *Agrilus b. bilineatus* (Web.)

Populations of this buprestid have fluctuated over the past few years. As a secondary pest, the two-lined chestnut borer is always associated with another stress such as top or whole-tree mortality of red oak (*Quercus rubra* L.). This is common following insect defoliations or drought occurrences. This year, the two-lined chestnut borer was found attacking red oak trees previously defoliated by the fall cankerworm (*Alsophila pometaria* (Harr.)) in the Midland and Penetanguishene area of Midhurst District. Oak mortality also associated with two-lined chestnut borer also occurred on mature red oaks in a residential neighborhood in Leamington, Aylmer District. These trees had been predisposed by gypsy moth defoliation.

Hop-tree leafroller, *Agonopterix pteleae* Barnes and Busck

For the second consecutive year, populations of this leafroller caused moderate (25-75%) defoliation on hop-tree (*Ptelea trifoliate* L.) host in Point Pelee National Park, Essex County, Aylmer District. Active feeding was ongoing in mid-August.

Poplar flea beetle, *Altica populi* Brown

Heavy browning of balsam poplar (*Populus balsamifera* L.) due to this insect was recorded across the northern portion of Pembroke District in 2006. In many instances, damage resulted in bronzed foliage followed by early leaf fall in the infested areas.

Twig pruners, *Anelaphus parallelus* (Newm.) and *A. villosus* (F.)

For the second consecutive year, populations of these two twig pruners caused noticeable damage to red oak trees. Damage levels in 2006 were lower than that reported in the region in 2005.

Branch mortality (1-10%) caused by the feeding of these twig pruners was present through the Kawartha Lakes of Peterborough and Bancroft districts.

Shorthorned oakworm, *Anisota finlaysoni* Riotte

This species of oakworm was recorded infesting red oak trees near Walsh Station, Norfolk County, Aylmer District. Defoliation reached 100% on juvenile trees within the stand while larger, mature trees sustained moderate-to-severe defoliation. Larvae were present and active well into early September, which is typical for this species of oakworm.

Orangestriped oakworm, *Anisota senatoria* J.E. Smith

This species of oakworm is a close relative of the shorthorned oakworm, and was at one time considered the same species. Populations of orangestriped oakworm were discovered causing moderate-to-severe defoliation on bur and black oak (*Q. macrocarpa* Michx. and *Q. velutina* Lam. respectively). High populations of the orangestriped oakworm caused up to 100% defoliation on the lower branches of mature trees and completely stripped juvenile trees along the edge of a spruce-pine woodlot near Brantford airport in Brant County, Guelph District.

Oak leaf tier, *Archips semiferana* (Walker)

An unconfirmed species of oak leaf tier, possibly *Archips semiferana* (Walker) was found in two areas of Pembroke District in 2006. Defoliation was aerially mapped along the Barron Canyon (Achray) road in Petawawa and McKay townships. The two hilltops of oak

trees within the 216 ha of defoliation appeared to have defoliation in the range of 60-80 percent. The affected trees averaged 15 meters in height and produced a second crop of smaller leaves that gave a thin appearance to the trees for the remainder of the summer.

Cedar leaf miner, *Argyresthia aureoargentella* Brower, *A. canadensis* Free **and arborvitae leafminer**, *A. thuiella* (Pack.)

Several years of severe cedar leaf miner defoliation coupled with impacts from the 1998 Ice Storm and 2005 drought have resulted in significant cedar tree deterioration. Top and whole tree mortality was delineated throughout an area of 16,204 ha, in the eastern portion of Southern Region (Figure 6.1).

The intensity of defoliation caused by the cedar leaf miner was greatly reduced this year, but top and whole-tree mortality continued to expand within the affected area in Kemptville District. The damaged area extended from the towns of Spencerville/Augusta through Oxford Station, Kemptville and Burritts Rapids north along Roger Stevens Road toward Dwyer Hill Road, Kemptville District.

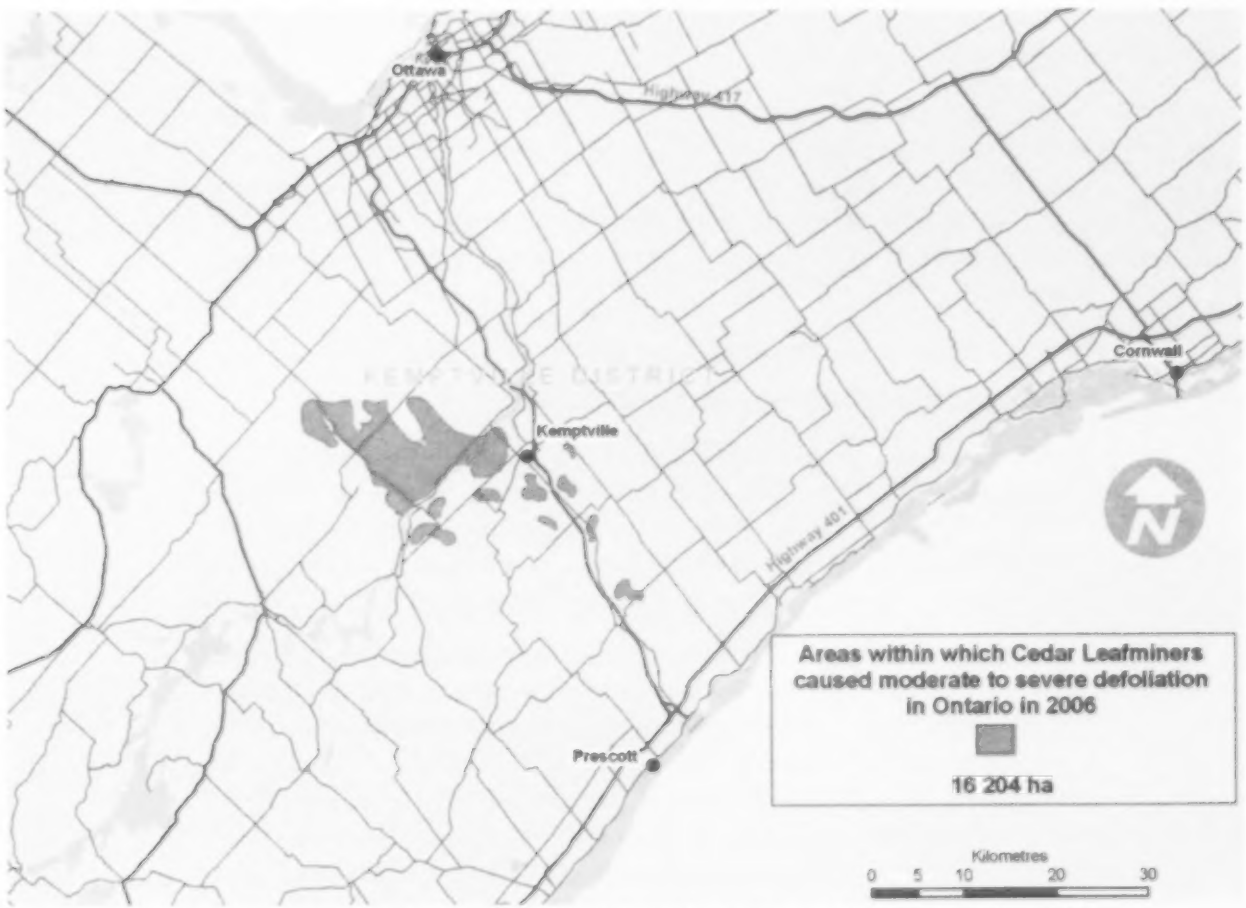


Figure 6.1 Areas within which eastern white cedar damage occurred in Southern Region, 2006.

The infestation previously reported near Round Lake and Golden Lake, Pembroke District, has collapsed to very low levels. Some top mortality has occurred on eastern white cedar (*Thuja occidentalis* L.) however aforementioned factors such as ice storm damage and drought have also played a role in the poor tree condition.

In Aylmer and Guelph districts the arborvitae leafminer caused moderate-to-severe defoliation on host trees growing in field windbreaks, shelterbelts and wooded areas.

Hickory leafroller, *Argyrotaenia juglandana* (Fern.)

In a most unusual event, aerial reconnaissance in 2006 found 925 hectares of moderate-to-severe damage caused by this insect in the region (Figure 6.2). Damage in the form of rolled leaves gave trees a thin crown appearance at the end of June and early July following the active larval period from mid- to late June.

The greatest area of damage was recorded in Aylmer District totaling 503 ha followed by 422 ha of defoliation in Guelph District. Moderate-to-severe defoliation of bitternut hickory (*Carya cordiformis* (Wang.) K. Koch) occurred in one woodlot north of Aylmer, Elgin County and on shagbark hickory (*C. ovata* (Mill.) K. Koch) in approximately 40 woodlots between Cayuga and Nanticoke, Haldimand County. Low levels of damage also occurred near St. Thomas, Elgin County, Aylmer District and also south of Brantford, Brant County, Guelph District.

Further east, in the Town of Oakville, the hickory leafroller caused moderate-to-severe defoliation of shagbark hickory in a few small areas. It was difficult to determine the full extent of the damage caused solely by this leafroller as gypsy moth (*Lymantria dispar)* was also present in the same woodlots. In these areas the leafroller, which is strictly confined to hickory, contributed to the overall level of defoliation attributed to gypsy moth.

Basswood leafminer, *Baliosus nervosus* (Panz.)

Basswood leafminer populations continued to increase in the western portion of the Southern Region. This leafminer has been recorded for several years in the central part of the Midhurst District but has become more widespread through Simcoe County and as far away as Bruce County, Huron and Perth counties, Guelph District; and Lambton and Essex counties and the Municipality of Chatham-Kent in Aylmer District.

While damage is typically heaviest on regeneration and in the lower crowns of large trees, in 2006 the damage was often evident throughout the crown. The adults feed early in the year on the leaves by skeletonizing leaf tissue while the leaves are still unfolding from the bud stage. Developing larvae then mine within the leaves, causing the typical brown, blotchy effect on the leaf. The combined effect of adult and larval feeding, when populations are high, can cause the trees to appear quite brown. Pupation occurs within the mine and then adults emerge. Adult beetles resume feeding again by skeletonizing any remaining green foliage they can find.

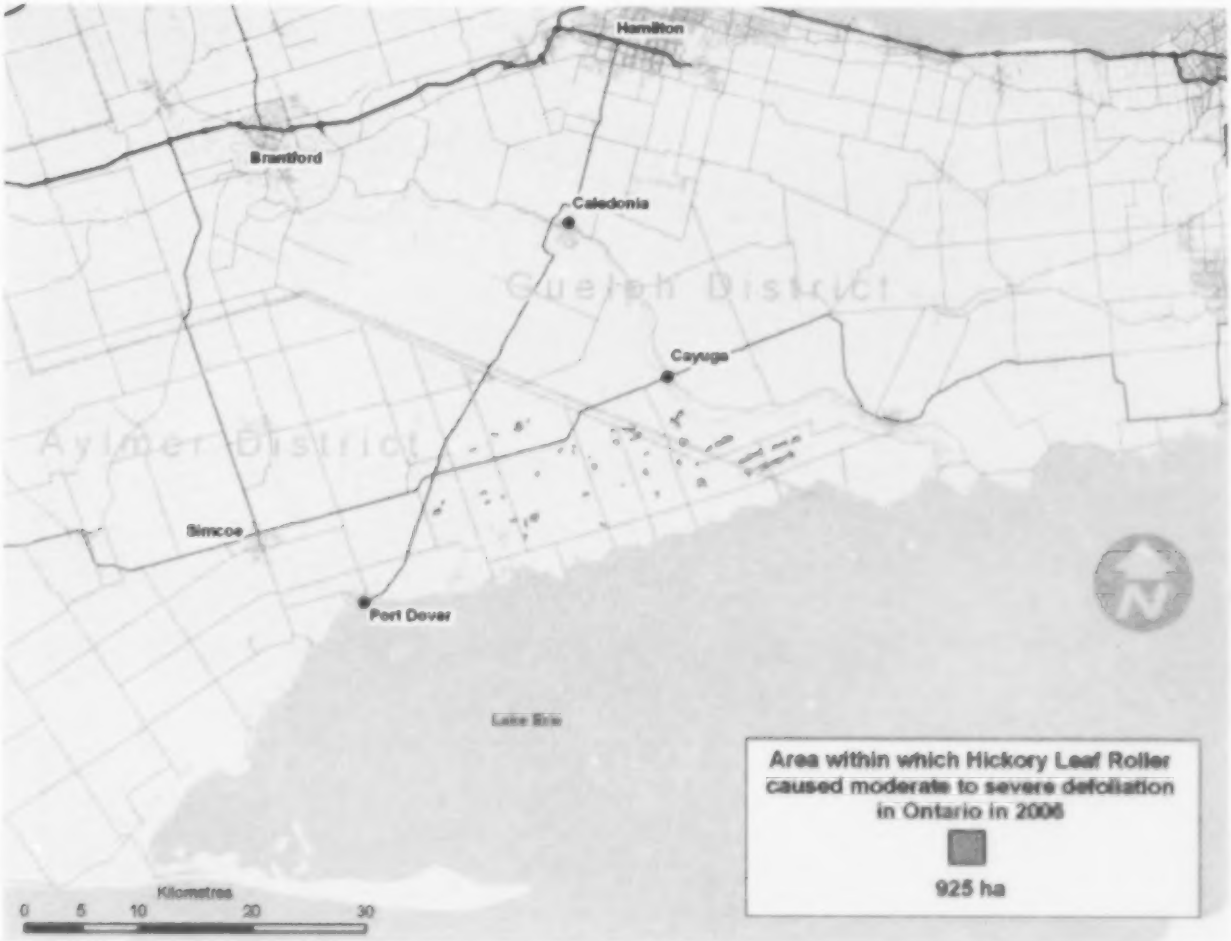


Figure 6.2 Areas within which hickory leafroller caused moderate-to-severe defoliation of hickory in Southern Region, 2006.

In addition to the discoloration, premature leaf drop was noted often resulting in heavy defoliation.

Although basswood (*Tilia americana* L.) is the favored host, moderate populations of the leafminer were observed on ornamental linden (*Tilia spp.*) trees at Wasaga Beach, Simcoe County, Midhurst District.

Birch skeletonizer, *Bucculatrix canadensisella* Cham.

Populations of this insect persisted in the Pembroke and Kemptville districts, while collapsing in the Peterborough and Bancroft districts in 2006.

Figure 6.3 Birch skeletonizer larvae feeding on birch leaf (photo by D. Rowlinson).

Area within which Hickory Leaf Roller caused moderate to severe defoliation in Ontario in 2006

925 ha

Damage was recorded in larger stands of white birch, however this insect causes damage late in the growing season and the impact on overall vigor of infested trees is likely negligible.

Oakslug, *Caliroa fasciata* (Nort.)

Populations of this slug sawfly encountered in 2006 were not nearly as widespread as what were recorded in 2005 through Aurora and Midhurst districts. Leaf skeletonizing was noted at moderate damage levels at one location on red oak saplings in Oro-Medonte Township, Midhurst District.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.)

The total area and intensity of infestation caused by populations of the large aspen tortrix have fluctuated considerably over the past several years, but have been high enough to cause moderate-to-severe defoliation of aspen stands somewhere in the region for seven of the last eight years (Table 6.1).

Table 6.1 Gross area of moderate-to-severe defoliation caused by the large aspen tortrix in the Southern Region from 2002-2006.

	Area of defoliation (ha)				
District	2002	2003	2004	2005	2006
Bancroft	2112	Low	3987	3997	0
Midhurst	0	Low	0	0	100
Parry Sound	0	0	256	2364	5937
Pembroke	137	Low	2338	1412	0
Total	2249	Low	6581	7773	6037

In 2006, stands of trembling aspen (*Populus tremuloides* L.) were mapped with moderate-to-severe levels of defoliation in Parry Sound District totaling 5,937 ha (Figure 6.4). The infestation was in the area around the community of Burk's Falls with the bulk of the defoliation present from Stirling Falls north to Katrine and south along Highway 11. Defoliation radiated out in varying amounts to the east and west from the highway corridor between these two locations. Defoliation was first detected in this area in 2004 when 256 ha of infestation were mapped; in 2005 it expanded to 2,364 ha and this year jumped to 5,937 ha. Four small scattered pockets of defoliation were also mapped west from Doe Lake, south to Emsdale, and east of Burk's Falls at Jack Lake.

There was a marked reduction in the population and intensity of the large aspen tortrix in Bancroft District. This year, defoliation was only at light levels on forest edge and roadside trees north and east of Bancroft in Monteagle, Carlow and Dungannon townships, Bancroft District.

Further south in the region, over 100 ha were defoliated by a complex of insects that included large aspen tortrix; darkheaded aspen leafroller (*Anacampsis innocuella* (Zell.)), and paleheaded aspen leafroller (*A. niveopulvella* (Cham.)). This combination of defoliators caused moderate-to-severe defoliation to trembling aspen at numerous

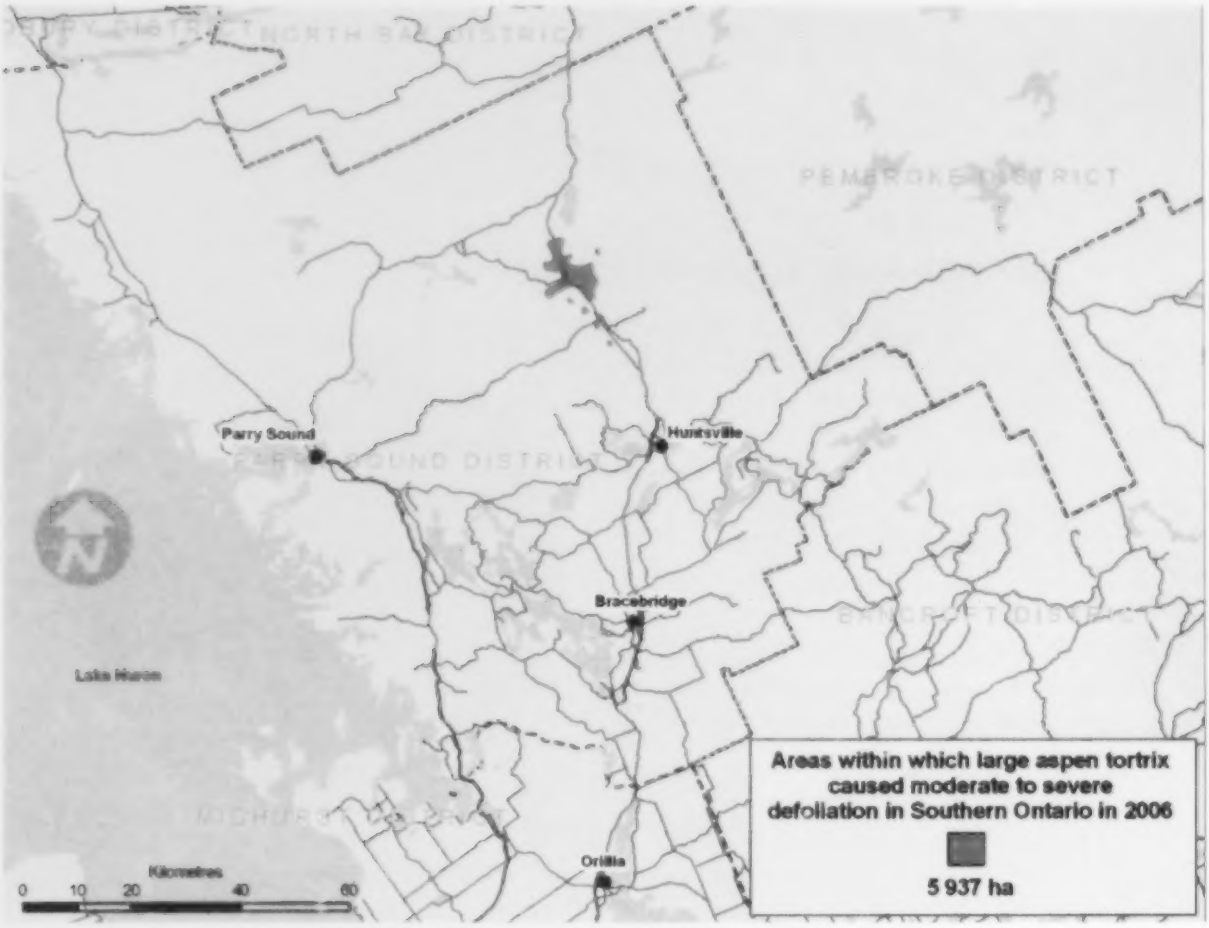


Figure 6.4 Areas within which large aspen tortrix caused moderate-to-severe defoliation of trembling aspen in Southern Region, 2006.

points in both Midhurst and Aurora districts. In general, small areas of aspen were affected at widespread locations from Springwater Township in Simcoe County to the Campbellville area of Halton Region. The biggest area affected was near Craighurst, Simcoe County. Moderate defoliation prevailed in all instances except for small clumps of aspen that on occasion were more heavily defoliated such as Essa Township, Midhurst District.

Maple trumpet skeletonizer, *Epinotia aceriella*

Light populations could be found in 2006 in most sugar maple (*Acer saccharum* Marsh.) stands examined in the eastern portion of the region, Pembroke and Kemptville districts. Defoliation was confined to the lower portions of the trees in most instances and generally occurred on less than 5 percent of the current foliage.

Pine needleminer, *Exoteleia pinifoliella* (Cham.)

The pine needleminer is a tiny lepidopteran whose larva feed in the interior of current year's needles. The feeding results in a skeletonized needle which eventually turns brown

Figure 6.4 Areas within which large aspen tortrix caused moderate to severe defoliation of trembling aspen in Southern Region, 2006.

points in both Midhurst and Aurora districts. In general, small areas of aspen were affected at widespread locations from Springwater Township in Simcoe County to the Campbellville area of Halton Region. The biggest area affected was near Craighurst, Simcoe County. Moderate defoliation prevailed in all instances except for small clumps of aspen that on occasion were more heavily defoliated such as Essa Township, Midhurst District.

Maple trumpet skeletonizer, *Epinotia aceriella*

Light populations could be found in 2006 in most sugar maple (*Acer saccharum* Marsh.) stands examined in the eastern portion of the region, Pembroke and Kemptville districts. Defoliation was confined to the lower portions of the trees in most instances and generally occurred on less than 5 percent of the current foliage.

Pine needleminer, *Exoteleia pinifoliella* (Cham.)

The pine needleminer is a tiny lepidopteran whose larva feed in the interior of current year's needles. The feeding results in a skeletonized needle which eventually turns brown

in the summer heat. Populations of the pine needle miner increased in Parry Sound District in 2006. Heavy needle browning of jack pine, *Pinus banksiana* Lamb. trees was observed in Carling Township north of the town of Parry Sound. In addition, a new infestation was found north of the aforementioned area in the Township of the Archipelago, south of Highway 644.

Fall webworm, *Hyphantria cunea* (Drury)

The occurrence and damage level caused by the fall webworm has been on the increase over the past few years in the Southern Region. This trend continued in 2006. Preferred hosts that were defoliated included black walnut (*Juglans nigra* L.) all species of ash (*Fraxinus spp.*) elm (*Ulmus spp.*) and cherry (*Prunus spp.*). In some cases, host trees were completely covered with webbing from numerous insect colonies (Figure 6.5). Other species of hardwoods were also attacked to a lesser degree.

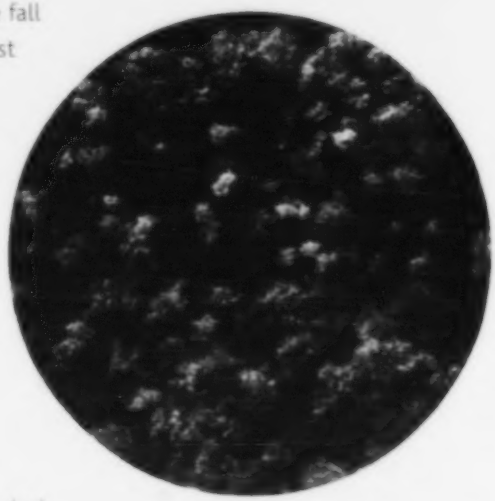


Figure 6.5 Fall webworm infesting black walnut at Point Pelee National Park, Essex County, Aylmer District in 2006 (photo by L. Tucker).

Although all districts in the region had populations of fall webworm, the most noteworthy damage occurred in the extreme southwest portion of the region, Aylmer District. A total of 319 ha of woodlots and forested land were infested (Figure 6.6). Several of these locations suffered moderate-to-severe defoliation.

In some woodlots numerous trees were 100% defoliated. One location included the wooded area in Point Pelee National Park, Essex County. Further north, several woodlots in the Municipality of Chatham-Kent and in the County of Lambton were also infested and sustained moderate-to-severe defoliation. During ground inspections, several woodlots in Oxford County were also noted to have moderate-to-severe defoliation.

Several locations in the County of Wellington and the Region of Waterloo also had several woodlots with moderate-to-severe defoliation. These were detected through ground inspection.

Very high populations continued in the area south of Lake Simcoe, Aurora District and at numerous areas in Midhurst District. The frequency of single trees exhibiting low to high levels of defolation was very high and common throughout Peterborough, Bancroft, Kemptville and Pembroke districts and through the southern and central portions of Parry Sound District. Infestation levels diminished further north.

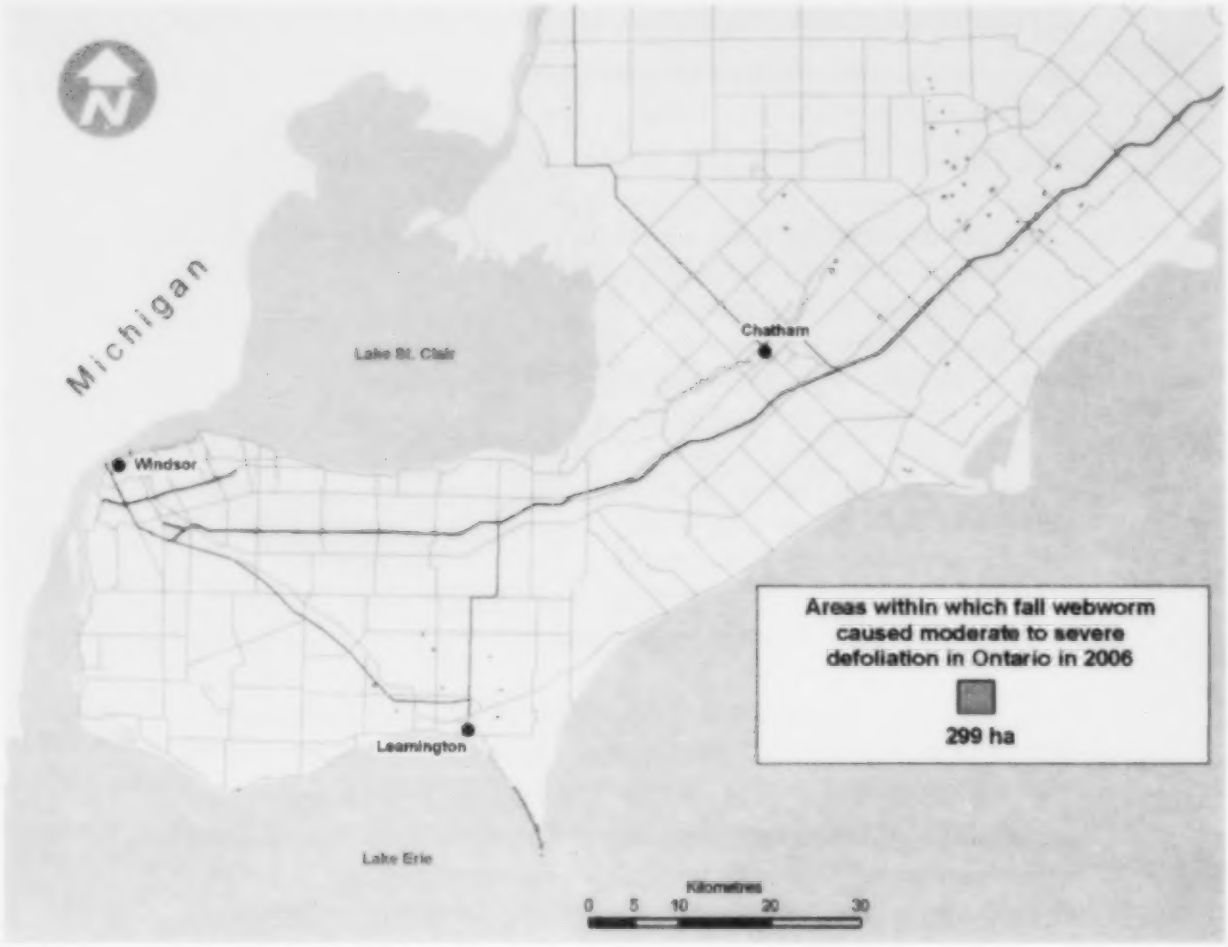


Figure 6.6 Areas within which the fall webworm caused moderate-to-severe defoliation of deciduous hosts in Southern Region, 2006.

Northern engraver, *Ips borealis* Sw.

Insects associated with the dieback and tree mortality of white spruce (*Picea glauca* (Moench) Voss) included the northern engraver and a spruce bark beetle, *Dryocoetes affaber* (Mann.) at Canadian Forces Base Borden east gate, Midhurst District.

Willow flea weevil, *Isochnus rufipes* (LeC.)

Damage caused by the willow flea weevil was recorded on host trees in the Parry Sound District in 2006. The foliage of shining willow (*Salix lucida* Muhl.) turned brown again this summer as a result of larval feeding damage from this insect. Population levels have been building for the past couple of years in Sudbury District, Northeast Region and this year was noted in the northern portion of the Parry Sound District, Southern Region.

Figure 6.6 Areas within which fall webworm caused moderate to severe defoliation in Ontario in 2006.

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Oystershell scale, *Lepidosaphes ulmi* (L.)

High populations of this insect were discovered for the first time since the mid-1990's causing significant damage at several locations in the region.

Damage levels reached 50-75% twig and branch dieback as a result of feeding by the oystershell scale on American beech (*Fagus grandifolia* Ehrh.) trees from Minden to Haliburton in the Municipality of Minden Hills, Bancroft District (Figure 6.7). Further south, an infestation on understory regenerating American beech trees suffered similar damage in the Wildman Tract, Simcoe County Forest, Midhurst District.

Figure 6.7 Oystershell scale infesting American beech foliage and branches in Minden Hills Township, Bancroft District in 2006 (photo by E. Czerwinski).

To the east, two persistent infestations of the oystershell scale have been monitored for the past few years; a stand of American beech trees near Palmer Rapids and a sugar maple stand in Canisbay Township, Algonquin Park, Pembroke District.

At these locations significant twig and some tree mortality on canopy trees has been recorded over the past three years. The impact on regenerating host trees in the affected stands has been much worse resulting in a high incidence of seedling and sapling mortality.

High population levels of this scale insect were also found in various areas of Parry Sound District. Mature beech trees with thin crowns were observed in Carling Township, particularly in and around Killbear Provincial Park. In stands where multi-year feeding has taken place, a low level of scattered tree mortality has resulted. Similar damage was present in the Lake of Bays area.

Eastern tent caterpillar, *Malacosoma americanum* (F.)

This insect feeds on all cherry species commonly growing at the forest edge, open sites and roadsides as well as in landscape plantings. It was encountered less frequently in the region in 2006.

Nonetheless, the eastern tent caterpillar is ubiquitous and persistent; it is rare for Forest Health survey staff not to encounter this insect. One of the first insects to attack cherry trees in the growing season, it was commonly encountered causing low-to-moderate defoliation.

Balsam fir sawfly, *Neodiprion abietis* (Leach)

There was a complete collapse of the populations of the balsam fir sawfly in the region in 2006.

Populations which have been persistent for several years on balsam fir (*Abies balsamea* (L)) in the central portion of the region did not recur this year. However, whole tree mortality occurred in 2006 in the formerly infested areas from Southampton to Sauble Beach, Midhurst District.

Redheaded pine sawfly, *Neodiprion lecontei* (Fitch)

Widely separated populations of the redheaded pine sawfly were recorded causing varying damage levels to red pine (*Pinus resinosa* Ait.) plantations in the region in 2006.

In South Alcona Township, Pembroke District, this sawfly was observed more frequently than in 2005 however damage was lighter and restricted to trees under 2 metres tall. Similarly, light defoliation was recorded in a few plantations in Kemptville District.

At Canadian Forces Base Borden, Midhurst District, high populations of the redheaded pine sawfly were again controlled using the nuclear polyhedrosis virus (NPV) in plantations with newly emerging problems. Elsewhere a few red pine saplings were severely defoliated on the Saugeen First Nation Lands near Southampton, Midhurst District.

High populations were also present in a red pine plantation in Laurier Township, Parry Sound District. As is common for this insect, low levels of top and whole tree mortality were the result of infestations here and across the Southern Region.

Maple leafcutter, *Paraclemensia acerifoliella* (Fitch)

Significant populations and the characteristic shot hole damage of the maple leafcutter failed to recur in the region in 2006 as compared to that encountered for the past two consecutive years.

In 2004, aerial reconnaissance disclosed small infestations in pockets totaling 492 hectares. In 2005, a significant increase occurred to 5,549 ha in Bancroft and Peterborough districts. In 2006, damage was restricted to a few locations in Effingham Township, Bancroft District. Leaf skeletonizing and browning with typical oval holes in the leaf surface occurred in stands of sugar maple making them easily discernable from a distance. No aerial mapping in 2006 occurred to quantify the extent of this small infestation.

White pine weevil, *Pissodes strobi* (Peck)

Populations of this destructive pest of eastern white pine (*P. strobus* L.) are on the rise in Kemptville and Pembroke districts. Damage levels ranged from 2-3% in plantations ranging in height from 1 to 3 metres. Few, if any signs of old weevil damage were observed in these plantations.

Figure 6.8 White pine weevil damage on Scots pine (photo by D. Rowlinson).

Chestnut brown bark beetle, *Pityogenes hopkinsi* Swaine

This opportunistic bark beetle was observed at many different locations throughout the region in 2006. Primarily a minor pest of juvenile eastern white pine trees, this bark beetle was found in large numbers breeding in trap logs placed for the pine shoot beetle (*Tomicus piniperda* (L.)) in Parry Sound District. Elsewhere, the beetle caused varying levels of shoot mortality in the lower crowns of mature eastern white pine during its requisite maturation feeding from Sandbanks Provincial Park, Prince Edward County, Peterborough District to Puslinch Township, Guelph District.

Birch leaf miner, *Profenusa thomsoni* (Konow)

Several small pockets of damage attributed to this insect were aerially mapped in the Pembroke District in Wilberforce, Alice and Fraser townships. This insect has caused damage in this area in recent years on white birch. In 2006, attacked stands were pure white birch between 10 and 12 meters tall and ranged from 0.5 to 2 ha in size. Within the stands all host trees were affected, but in most cases the larger trees received up to 100 % defoliation.

Basswood thrips, *Sericothrips tiliae* Hood

High populations of this native thrips attacking basswood were reported across the Peterborough District, Durham County, Aurora District and in the Bolton area of Peel Regional Municipality. Defoliation was often recorded up to 90%.

Hickory bark beetle, *Scolytus quadrispinosus* Say

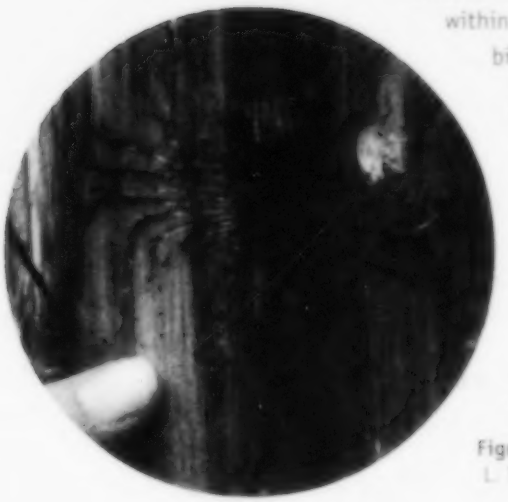
Damage from the hickory bark beetle is caused by both the adult and the larvae (the latter causing the most significant damage). Adult beetles feed at the base of the leaf petioles and on the twigs. After feeding, they mate and bore into the tree bole and/or branches where the female constructs vertical galleries and lays her eggs. Upon

hatching, the developing larvae begin to feed horizontally crossing the grain between the bark and the cambium layer. The larvae spend the winter and eventually pupate under the bark in the spring, emerging as adults from early June into July.

The native hickory bark beetle is considered to be the most destructive pest of hickories. It was first reported in 2001 to be causing landscape-level tree mortality or decline of hickory trees in Aylmer and Guelph districts. From then until 2005, damage caused by this insect has increased exponentially.

Previous aerial reconnaissance disclosed individually infested woodlots. In 2001, 127 hectares of damage was recorded, affecting approximately 20 woodlots in Middlesex County. In 2002, 48 more woodlots were delineated, occupying a cumulative total of 409 hectares. Aerial reconnaissance in 2004 revealed approximately 250 woodlots infested totaling some 2,133 hectares. Affected counties included: Middlesex, Elgin, and Lambton counties, Aylmer District, and Huron County, Guelph District.

Due to the continually expanding infestation, in 2005 the mapping changed from individual or portions of woodlots to the areas within which decline or mortality was occurring. Three distinct pockets of damage totaling 344,982 hectares were delineated (Figure 6.10). In 2006, there was very little damage beyond that recorded in 2005. However, beetle activity was noted to be increasing in intensity within infested woodlots and additional tree mortality of bitternut hickory is reaching 100% in these stands.



This outbreak followed drought-like conditions experienced in the Southern Region in 2001 and 2002. The population explosion of the hickory bark beetle likely occurred as a result of the abundant availability of stressed hickory trees, primarily bitternut and shagbark hickory. In most locations, high numbers of the hickory timber beetle (*Xyleborus celsus* Eichhoff) have occupied niches in the dead and dying hickory trees.

Figure 6.9 Hickory bark beetle larval galleries (photo by L. Tucker).

Maple leafroller, *Sparganothis acerivorana* Mack. **and maple-basswood leafroller**, *S. pettitana* (Rob.)

The maple leafroller occasionally causes epidemics in localized areas of Ontario. The larvae feed on all varieties of maples, but seem to prefer sugar maple. Mature larvae are about 23 mm long and vary from pale yellow to shades of green to dark brown. During summer, the female deposits her eggs in irregular masses on the leaves or other parts of the trees. The eggs appear to hatch before fall and the larvae overwinter in their hibernacula. The following spring, young larvae feed as the buds begin to swell and later roll themselves up in the developing leaves. Maple leafrollers are naturally

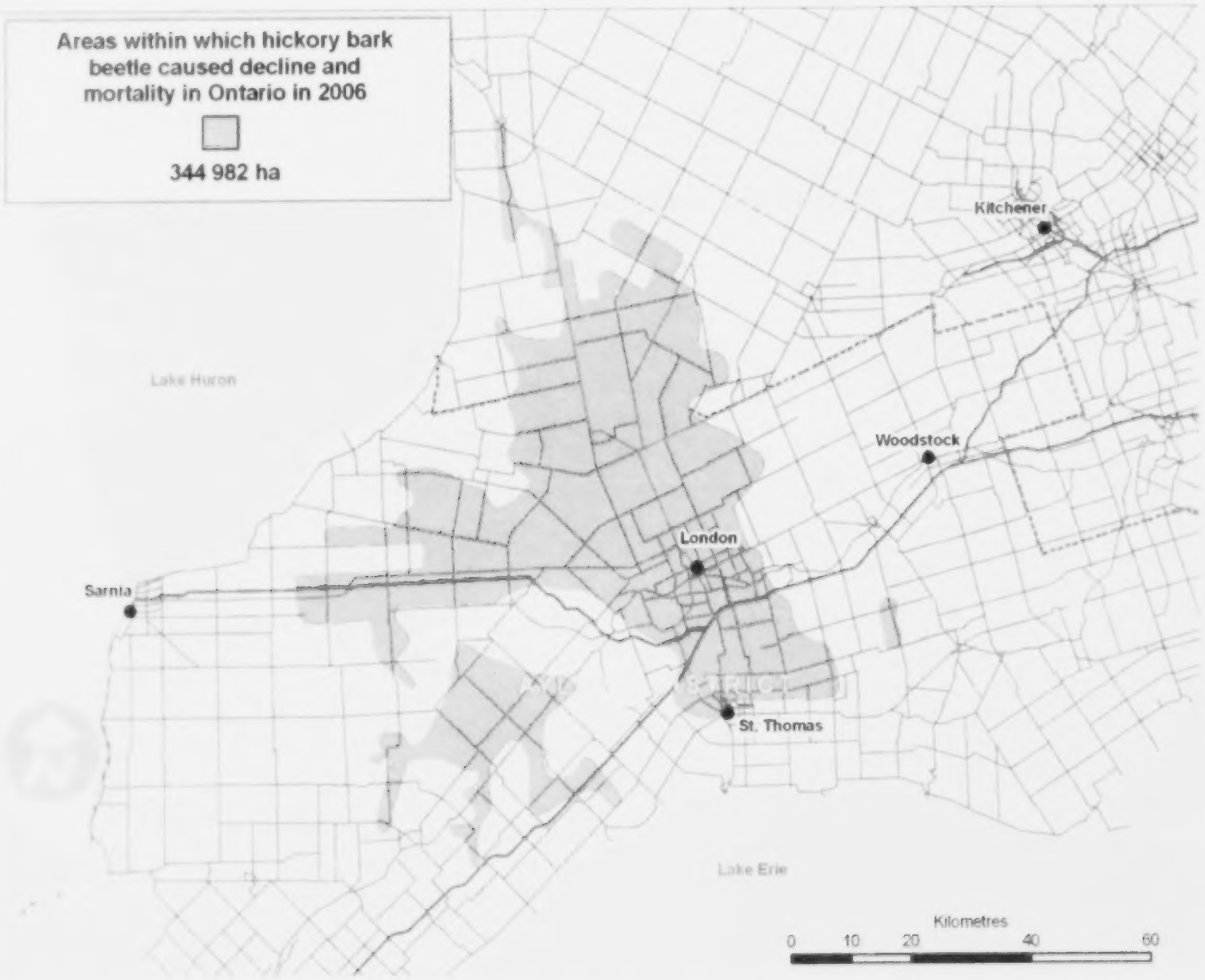
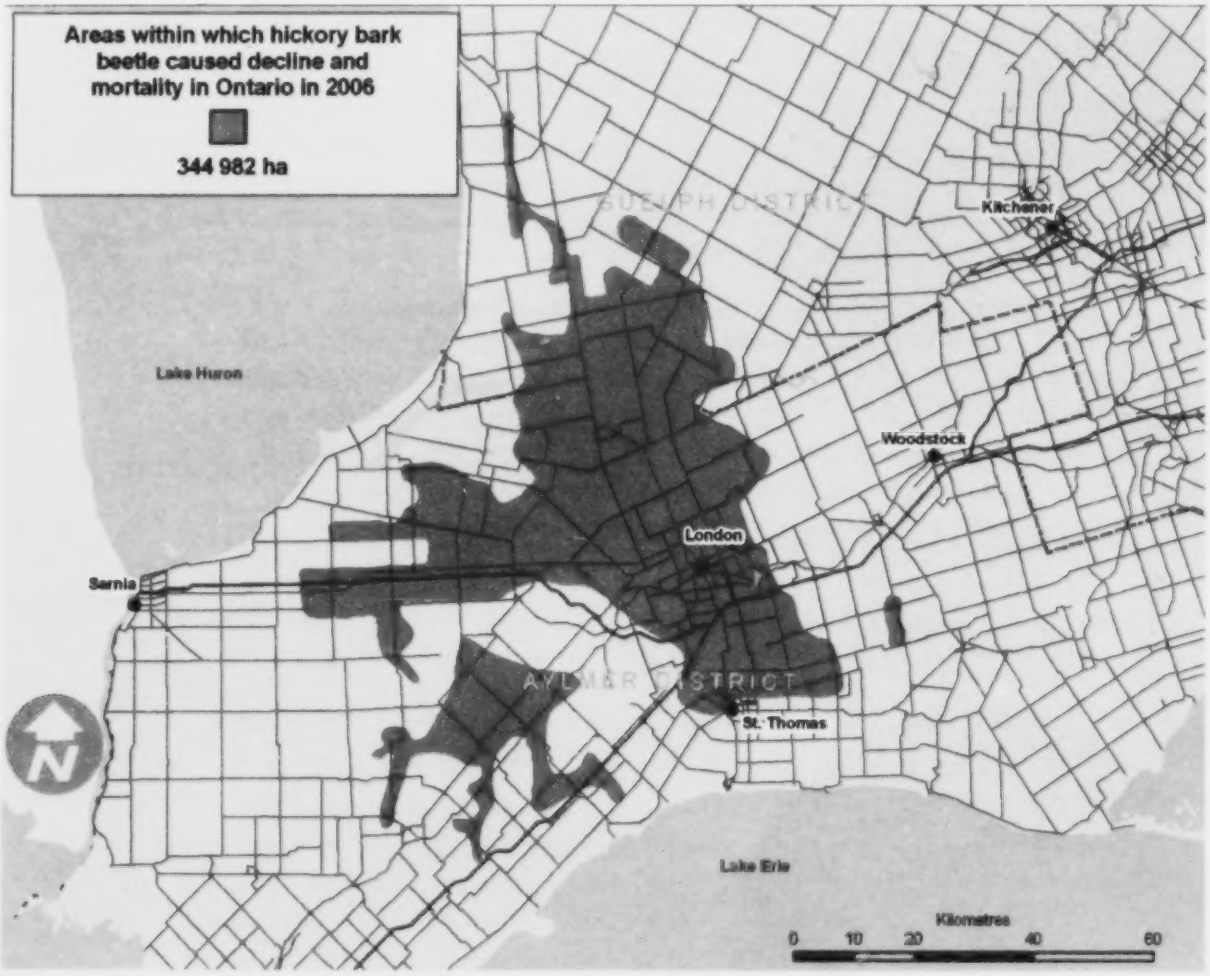


Figure 6.10 Areas within which the hickory bark beetle caused mortality of hickory in Southern Region, 2006.

controlled by a variety of parasites and predators, notably parasitic wasps, spiders and birds. The presence of rolled leaves in late May and leaves hanging vertically during the entire season are characteristics of attack by the maple leafroller.

When populations are high, the foliage turns brown and the crowns may be completely defoliated. The impact on the tree is generally negligible, but where defoliation is severe, dieback and mortality of already weakened maples may occur.

Maple leafroller populations were recorded at many widely separated sites across the region in 2006. At one site in Galway, Cavendish and Harvey Township, Peterborough District 10-25% defoliation of sugar maple and basswood was recorded. In a wooded area to the northwest of Newmarket, Aurora District, defoliation averaged 50% and was restricted to sugar maple. A total of 13 ha were infested at this site. Further north, sugar maple trees hosted high populations of the leafroller in much of Pembroke District and the infestation was noted to cross into the neighboring province of Quebec.



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Redhumped oakworm, *Symmesteria canicosta* Franc.

This year, there was a complete collapse in the redhumped oakworm population which had been recorded around Kasshabog Lake, Havelock- Belmont Township, Bancroft District the previous two years.

In 2005, moderate-to-severe defoliation caused by the oakworm was recorded at 185 hectares, which was a 90% reduction over that delineated in 2004, when defoliation totaled 2,064 hectares. Red oak was the primary host, although white oak (*Quercus alba* L.) was also defoliated during the outbreak.

Wood wasp, *Urocerus taxodii* (Ashmead)

Native to Florida, Mississippi, Missouri, Virginia and Washington, D.C., this wood wasp known only to occur in Baldcypress (*Taxodium distichum* var.*distichum*) swamps, was collected for the first time in Canada in 2006. As part of a larger survey for the invasive exotic wood wasp (*Sirex noctilio* Fabricius) a single adult *U. taxodii* was captured in a 12-unit Lindgren trap on August 4, 2006 in a red pine stand near Warsaw, Ontario, Douro-Dummer Township, Peterborough District. There is no expectation of a population established near this location. This may just be a capture of accidental wandering of a species that could well have been blown in following windstorms which occurred in July and early August across southern Ontario in 2006.

FOREST DISEASES

Anthracnose, *Apiognomonia errabunda* (Roberge) Höhn. and *Discula fraxinea* (Peck) Redlin & Stack

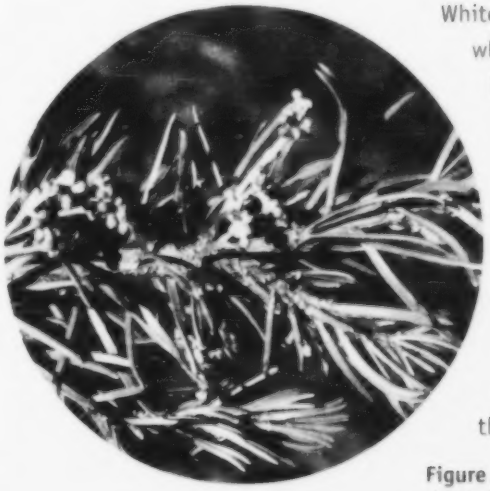
Low-to-moderate levels of foliar damage occurred in the southern portion of the region in 2006.

Damage was found on all ash and oak species throughout Aylmer, Guelph southern Aurora and Peterborough districts. This was a significant reduction in damage levels compared to that experienced in the region in 2005.

Eastern dwarf mistletoe, *Arceuthobium pusillum* Peck

The eastern dwarf mistletoe was very prevalent on the Bruce peninsula, Bruce County, and at one location near Angus, Midhurst District this year.

High numbers of witches'-brooms have occurred on trees along the west side of the Bruce Peninsula in the Old Woman's River area as well as in the Dorcus Bay area, Municipality of Northern Bruce Peninsula.



White and black spruces were noted to be equally affected while substantial tree mortality occurred. At one location near Dorcus Bay, this parasitic seed plant was found on jack pine resulting in whole tree mortality.

Eastern dwarf mistletoe occurs in the northwest part of the Bruce peninsula where the landscape is very rocky and trees are typically short in height. Much of the area is considered to be an alvar. Tree cover is sparse and the site is subject to flooding and drought-like conditions. Alvars are known for their distinctive flora and fauna.

Figure 6.11 Eastern dwarf mistletoe on jack pine (photo by D. Rowlinson).

Further south in Midhurst District, dwarf mistletoe was recorded at Canadian Forces Base Borden. There were numerous trees affected in a white spruce stand near the east entrance to the base. Some tree mortality and dieback occurred.

White pine blister rust, *Cronartium ribicola* J.C. Fisch.

The incidence of damage by this destructive organism is common and appears to be increasing in Pembroke and Kemptville districts and Algonquin Park. Although this was not a good year for fruiting of the organism, many signs of damage such as branch tip flagging occurred in the southern portion of Pembroke District and in LaRose Forest in Kemptville District.

Leaf spot of hickory, *Gnomonia caryae* F.A. Wolf

Localized infection of shagbark hickory foliage at low to moderate damage levels (10-25%) was encountered in Haldimand County, Guelph District.

Fomes Root Rot, *Heterobasidium annosum*

Tree mortality of red pine has been recorded in small pockets where this root rot organism has been found. There are now five active pockets in La Rose Forest and two active pockets in Limerick Forest; all seven areas of concern are within Kemptville District.

In Limerick Forest, the largest pocket contains 9 dead trees with an additional 2 new dead trees in 2006. In LaRose Forest, the largest pocket of damage totals 23 dead trees with an additional 3 new dead trees in 2006. All areas of damage by this organism exhibited heavy fruiting of Fomes root rot in 2006.

Monitoring work will continue in 2007 to establish the extent of the affected areas and new areas will be examined for the presence of this organism's fruiting bodies.

Poplar Marssonina, *Marssonina populi* (Lib.) Kleb.

This foliar disease of trembling aspen was recorded throughout the urban and rural landscape of Peterborough District. Some clonal clumps of host trees sustained as much as 100% foliar damage as a result.

Diplodia tip blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

Infection caused by diplodia tip blight was commonly encountered across the southern portion of the region in 2006. The disease is ubiquitous throughout the range of the pine shoot beetle at varying levels of infection. Scots pine, red, Austrian (*P. nigra* Arnold), and jack pine were all affected.

Leaf spot, *Tubakia dryina* (Sacc.) B. Sutton

There was only one record of this foliar disease this year, causing severe damage to mature, semi-mature, and young pin oak (*Quercus palustris* Muenchh.) in the Town of Lasalle, Essex County, Aylmer District in 2006.

Willow scab, *Venturia saliciperda* J. Nuesch

Black willow (*Salix nigra* Marsh.) growing in riparian areas throughout Aylmer and Guelph districts suffered moderate-to-severe damage as caused by the willow scab fungus. This damage was in the form of leaf spotting and premature leaf fall.

FLOWER AND SEED CROP

An unusually heavy flower and seed crop occurred on most tree species throughout the Southern Region in 2006. It was a bumper seed crop for many trees. Of the hardwoods noted maple, basswood, beech, ironwood, ash, poplar and elm all had heavy flower and seed crops. Coniferous species noted with increased cone and seed crops included spruce, cedar, larch, fir and hemlock (Figure 6.12).

Some trees developed so much flower and seed that current foliar production was reduced. Some tree species, for example red maple (*Acer rubrum* L.), put out only very few leaves following the production of larger amounts of flowers than normal. The trees appeared to be defoliated as a result for the remainder of the growing season.

Figure 6.12 Heavy cone crop of spruce experienced in the Southern Region in 2006 (photo by E. Czerwinski).

Heavy flower, seed and cone crops contributed to challenging conditions in delineating forest insect and disease outbreaks while conducting aerial reconnaissance.

FOREST ABIOTIC EVENTS

Drought damage

In 2006, a total of 7,070 ha of drought damage was aerially mapped in the Pembroke District.

In the Mount Ste. Patrick range north of Black Donald Lake, Brougham Township, Pembroke District, mature red pine growing on hilltops showed significant branch flagging and whole tree mortality. Ground examinations revealed that drought conditions existed on these sites and an increase in the presence of root rot was noted.

Hardwood trees on these sites also exhibited symptoms of drought stress as foliage appeared off-colour and wilted. Aerial surveys detected these symptoms in the area north of Black Donald Lake. This was bounded by the mountains to the north and west by Highway 41 (Figure 6.13).

Salvage operations in drought-affected areas were undertaken by the SFL (Sustainable Forest License) holder in the Ottawa Valley Forest.

Further south in the region, drought damage occurred. This was characterized by chlorotic foliage, leaf scorch, brown curled leaves and premature leaf drop for the second consecutive year in early August. The largest area of damage was noted to be in the Carden Plain, western Bancroft and Peterborough districts.

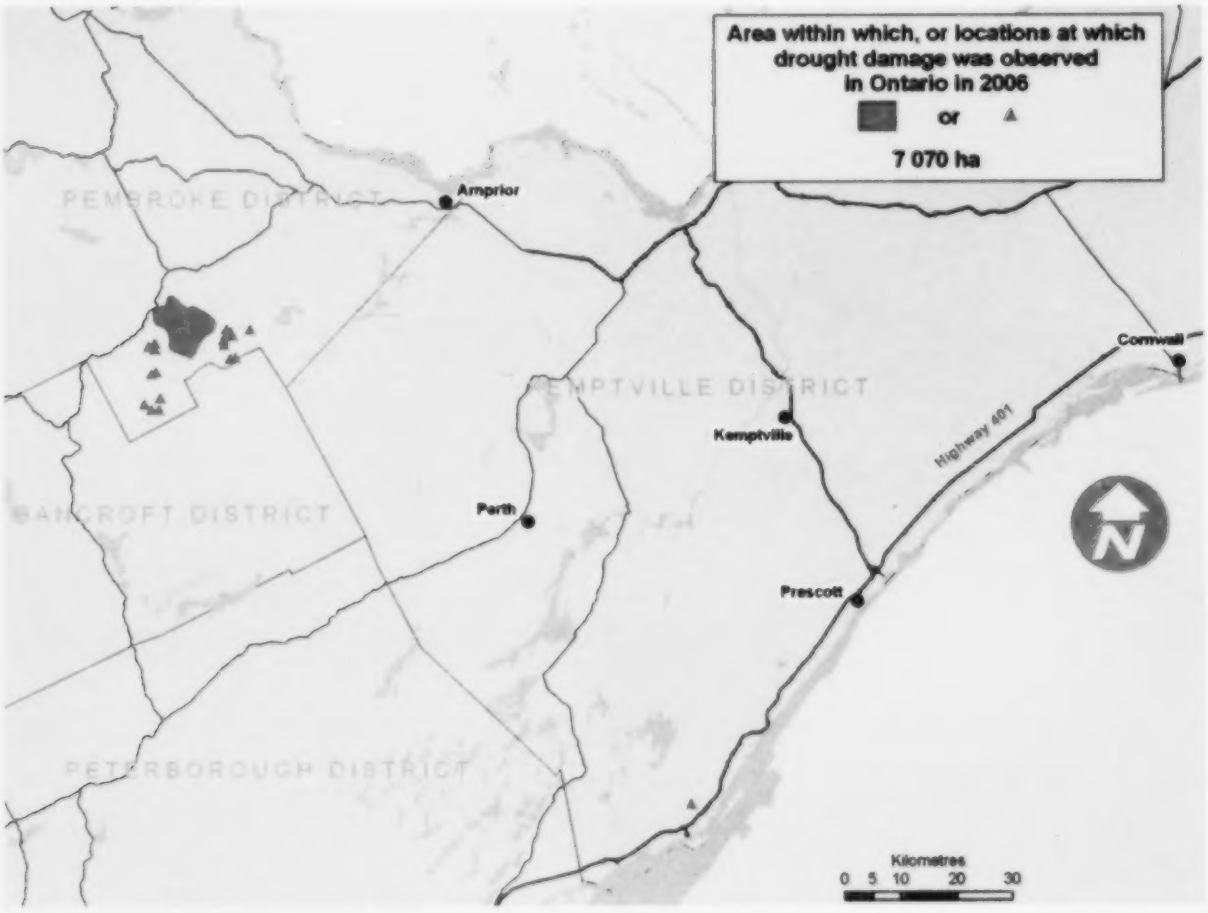


Figure 6.13 Areas within which drought damage occurred in Southern Region, 2006.

Storm, tornado and wind damage

There were at least five noteworthy wind events in 2006 that affected forest conditions in the Southern Region. The area that could be delineated using aerial reconnaissance methods totaled 17, 988 ha in the region (Figure 6.14). This represented approximately 32% of the total area of damaged forests from wind in the province of Ontario in 2006, and a 90% reduction in the area of forest damage compared to that which occurred in 2005.

The first was a winter storm that occurred in early February causing considerable tree damage through Bruce and Grey counties, Midhurst District. There were numerous widely scattered locations of damage to both conifers and hardwoods. In areas of Scots pine, storm damaged trees became breeding sites for the pine shoot beetle.

The second consisted of three separate storms on July 17, 2006. Two developed in Pembroke District and a tornado possibly touched down in the Newmarket area, Aurora District. Property damage occurred and a swath of trees were leveled in the Eldred King Tract of York Regional Forest, east of Newmarket, Aurora District. A total of 4 ha were recorded as damaged.

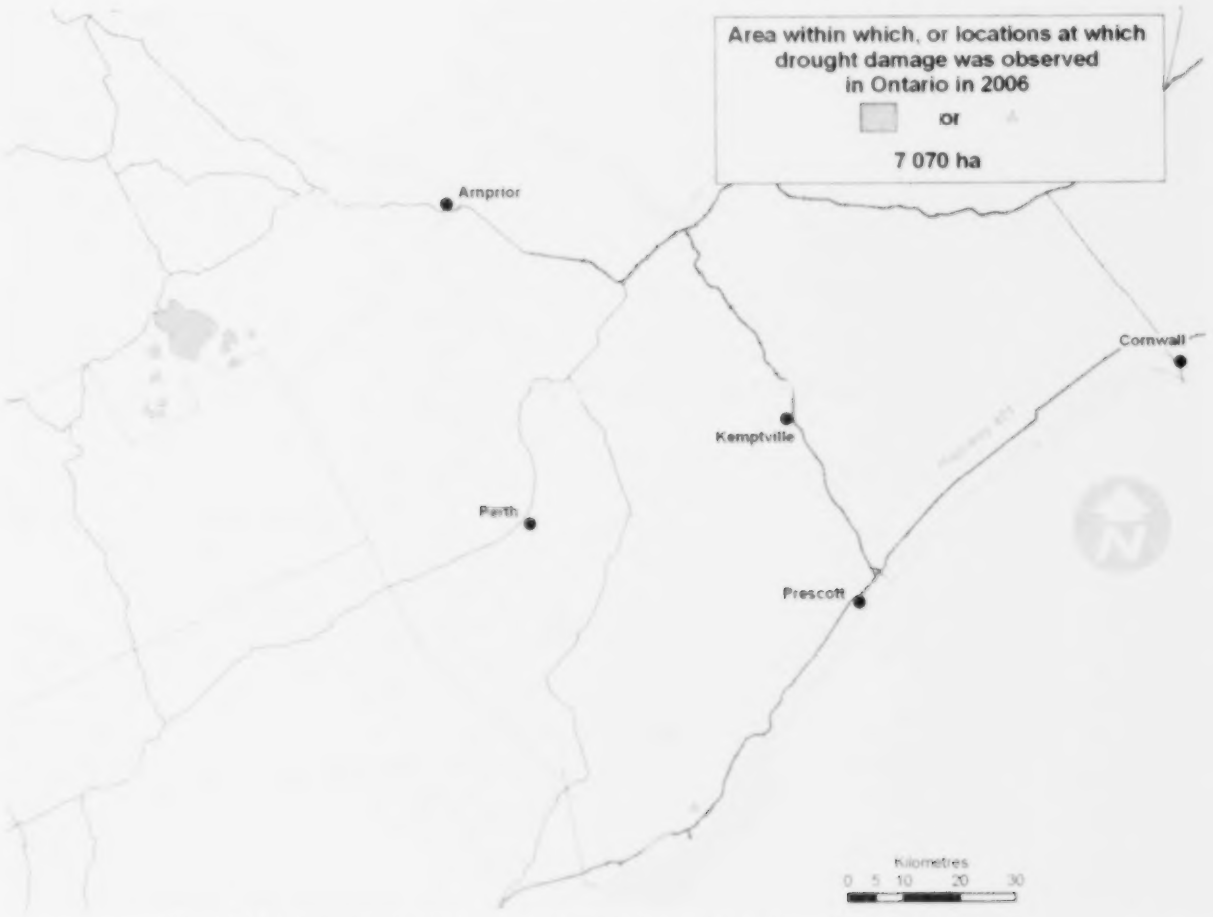


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Figure 6.14 Areas within which storm, wind, tornado damage occurred in Southern Region, 2006.

In Pembroke District, this wind event entered the Ottawa River at Deux Rivieres and extended along the river into the Deep River and Petawawa areas before leaving the province to carry on into Quebec, totaling 13, 979 ha. Many areas along the Ottawa River between Mattawa and Rolphton had large areas of blowdown. In Algonquin Provincial Park the main body of damage commenced near Kiosk and followed an old rail-bed and lake system into the Brent area. The two storms combined forces in Brent, hop-skipping over hilly terrain through four townships, until the storm eventually lost velocity near Achray. Some smaller areas were recorded east of this location until it reached the Ottawa River and passed into Quebec.

The third severe storm of the year occurred the night of August 2. At least eight separate tornados ripped through forested and cottage country in Bancroft District, ending in Pembroke District. The paths of destruction were distinct totaling a minimum of 4,005 ha (Figure 6.15). Trees were laid flat in most cases, but at times were shredded, torn and ripped from their main stem. The largest area of damage was recorded in the Madawaska Highlands, extending some 32 km long and up to a

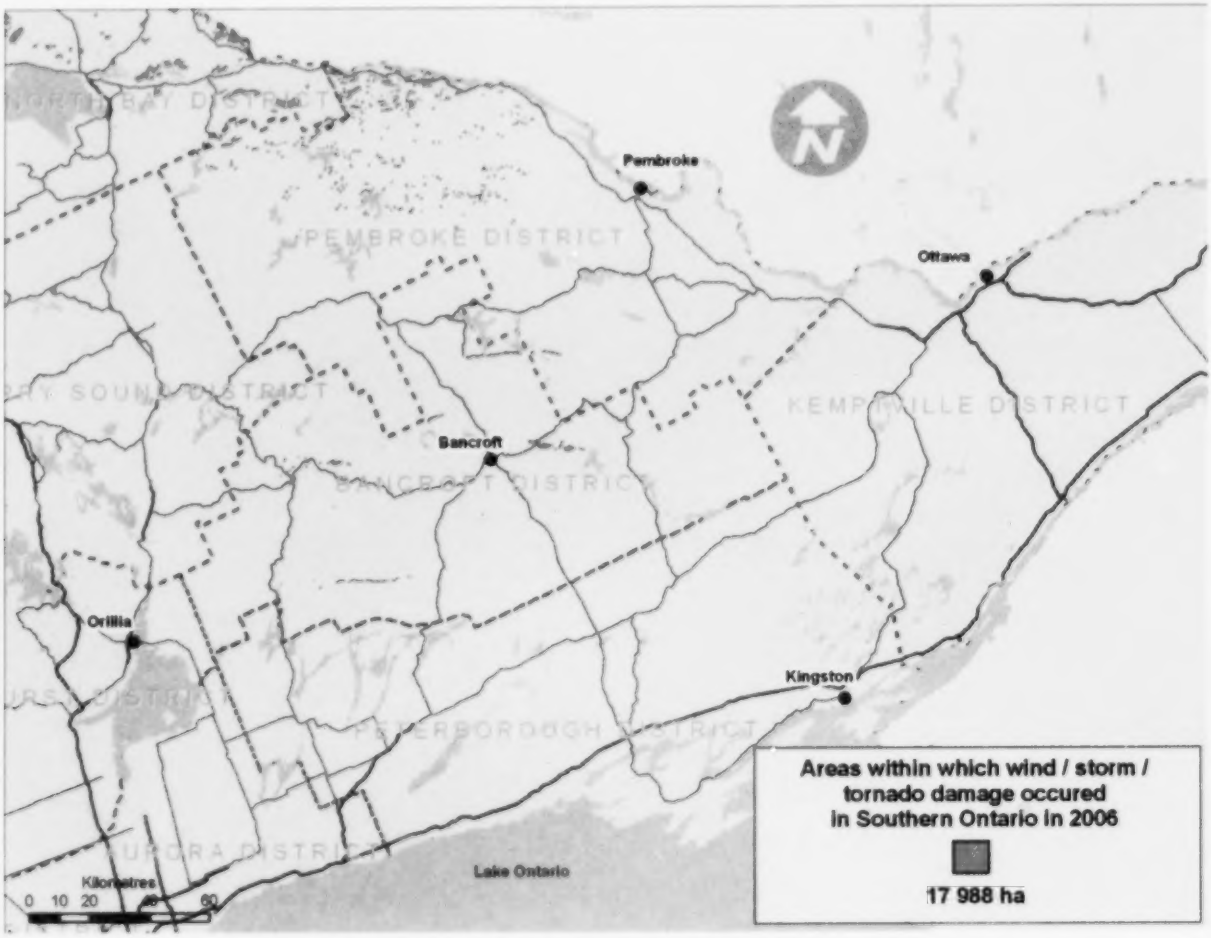

Figure 6.14 Areas within which storm, wind, tornado damage occurred in Southern Region, 2006.

In Pembroke District, this wind event entered the Ottawa River at Deux Rivieres and extended along the river into the Deep River and Petawawa areas before leaving the province to carry on into Quebec, totaling 13, 979 ha. Many areas along the Ottawa River between Mattawa and Rolphton had large areas of blowdown. In Algonquin Provincial Park the main body of damage commenced near Kiosk and followed an old rail-bed and lake system into the Brent area. The two storms combined forces in Brent, hop-skipping over hilly terrain through four townships, until the storm eventually lost velocity near Achray. Some smaller areas were recorded east of this location until it reached the Ottawa River and passed into Quebec.

The third severe storm of the year occurred the night of August 2. At least eight separate tornados ripped through forested and cottage country in Bancroft District, ending in Pembroke District. The paths of destruction were distinct totaling a minimum of 4,005 ha (Figure 6.15). Trees were laid flat in most cases, but at times were shredded, torn and ripped from their main stem. The largest area of damage was recorded in the Madawaska Highlands, extending some 32 km long and up to a

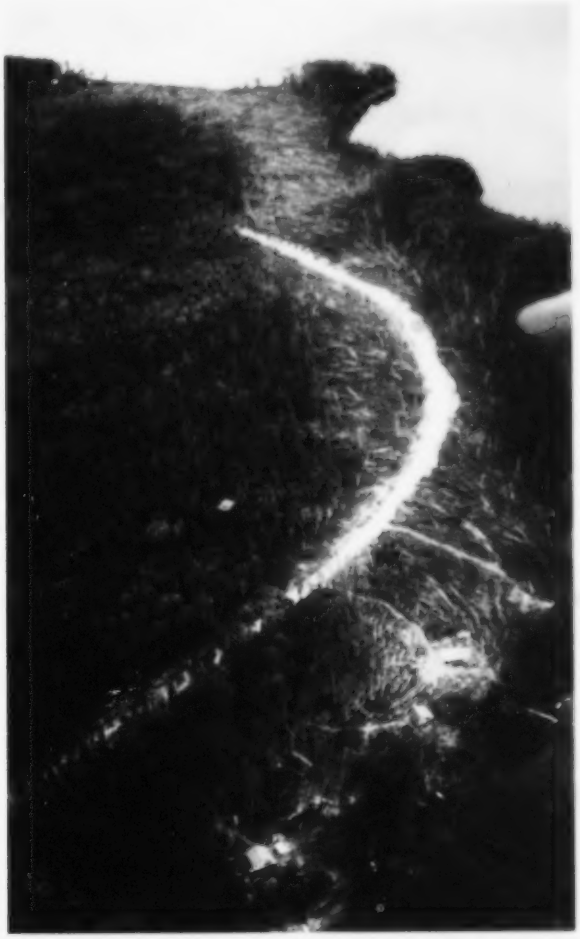

Figure 6.15 Path of tornado damage in Bancroft District in 2006 (photo by D. Krahn).

kilometer wide, through the small community of Combermere and ending in Radcliffe Township, Pembroke District.

The fourth significant storm of the year occurred on September 24, in Parry Sound District, but no areas of distinct mappable forest damage occurred. The damage was widespread and sporadic with small clumps or individual trees affected and could not be captured as a major disturbance to the forest. Nonetheless significant property damage, power outages and road blockages did occur.

The fifth was a winter storm that occurred in the Niagara Region affecting the towns of Fort Erie, Welland, and Port Colborne, Guelph District. Beginning in the afternoon of October 12 and ending the following day, a massive snow storm with winds up to 90km/hr swept through the Fort Erie area dumping 30-50cm of snow. Several residential trees were damaged or downed due to heavy winds and the weight of the snow and ice.

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